JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXXII., No. 2740.] TUESDAY, NOVEMBER 16, 1915. [67TH YEAR.

EDITORIAL NOTES.

State-Aided Research for Industry.

RETURN can now be made to the consideration of the very practical criticism and advice (which appeared in our "Correspondence" columns last week) tendered by Professor W. A. Bone, F.R.S., in respect of the Government scheme for the organization and development of scientific and industrial research. Such a scheme materialized has long been overdue. While the Government have been devoting much time, and expending lavishly on the details of our domestic life and affairs, they have simply bye-passed the very foundation—that of industry—upon the security of which our national prosperity relies. But this is not the time for reproach; it is the time to be thankful that the Government have seen the error of neglect, and to utilize this fact and their proffered aid to the best advantage by bringing to bear upon it good constructive effort. The scheme now before us can only justify itself by result; and to attain this there must be, precedent to the organization and development of research, proper organization of the scheme itself—organization which will ensure its growth on sound and profitable lines. Any failure in this preliminary can only mean subsequent disaster in the production of a crop of indifferent results; and there will still proceed the old waste of scientific and industrial brain power, arising from the want of system and co-ordination of work, and opportunity for bringing scientific aid to bear upon the solution of problems and the evolution of more efficient plant and methods.

The danger of this, and other things, is foreseen by Professor Bone, through the medium of a large personal experience; and so he has been examining the scheme in perspective, and has attempted to focus what, in his view, are the correct fundamentals to adopt. Everything in the way of success depends upon the accuracy of determination at the beginning. Too much must not be attempted at first; and there must be shrewd discrimination as to the initial courses of investigation to be pursued. The first essential is a central fund for subsidizing a limited number of lines of investigation. The second essential has equal importance. The scheme must not become, for men—however learned—who have no knowledge of industrial affairs, a haven of refuge in which each can pursue his own bent in research without a definite objective, and without some competent guidance. Professor Bone's specification of the men required is: "Scientific workers and technologists of repute "who are, or who have been, sufficiently in touch with "practical affairs to have acquired at first hand a real "knowledge of industrial affairs and of the economic factors "which will necessarily come into play in connection with "any new development." We are pleased to see that he gives forefront place to this point; for the man factor is of paramount importance in the success of the scheme. To make assurance doubly sure, he counsels an advisory body drawn from (say) the technical associations of the industries to direct the prosecution of the investigations selected.

The second practical point made is found in the considerations governing the selection at the outset of particular lines of investigation. These lines may be summed up by stating that they are those which show best promise of bringing to industry and the nation, in the shortest space of time, the most material returns. The capturing of the successes that are nearest within reach of systematized effort and exploration will be nationally valuable and encouraging to both the State and the workers. Professor Bone sees in the endeavour to recover lost industries, to protect by scientific development those which may be threatened in the near future, and to produce betterment in the utilization of our raw materials (coal and bye-products), work which immediately lies at hand, and which will enhance the country's prosperity. Other considerations which should likewise be taken into account are the probability of there being a successful issue to the investigations within reasonable time; and the fact that the investigation involves expenditure beyond the financial resources either of the individual worker or of the institution in, or in connection with, which he may be working. There can only be endorsement of these suggestions, as well as of the three distinct classes of investigation which are put forward, and which, briefly stated, would seek: To establish new and more accurate scientific data or methods involved in the design of industrial appliances and plant, or in the daily scientific control and supervision of important manufacturing processes; to promote the greater efficiency of present plant and methods; and to convert scientific discovery into some really useful scientific invention.

So far, there is no difference with Professor Bone; only complete accord. In what follows, there may similarly be no substantial difference. But this depends on what is connoted by the repeated use by him of the term "scientific." If the word has, in its application here, limited definition, it requires expansion; if he intends a broad definition, there is little or nothing to cavil at in regard to it. In the latter event, it simply requires supplementing by another term. Before dealing with this point, however, let us say we have never been able to agree with the narrow-minded folk who think scientists working in our public institutions should not materially benefit from the fruits in invention of their talents, and their patience and perseverance in research. There is little use to oneself, beyond the honour, in being endowed with special gifts if their exercise is only to result in one being for ever tethered to a fixed reward and no encouragement or gain beyond. Therefore, it is only consonant with our past views in this matter to agree with Professor Bone that the individual "scientific" investigator, though he obtains assistance from the central national research fund, should be accorded the fullest credit and protection for the ideas he may disclose, and that his rights and interests in the commercial results of such invention should be equitably provided for and ensured. In other words, the "scientific" worker ought not to be in any worse position in regard to the development of his discoveries merely because he is financially assisted by the State than he would have been had he been financed privately; and unless this principle is conceded at the outset in connection with the Government scheme, it will never attract, or be invoked by, the "scientific" inventor for the development of his ideas.

There is concurrence with these points, which, as stated here, simply paraphrases Professor Bone's own more extended submissions. But it will be observed how consistently the writer prefixes to "investigator," "worker," and "inventor" the adjective "scientific." This is where it appears to us that a little amplification is desirable on the part of the Professor. The scheme would lamentably fall short in good effect and profit if only the ideas and discoveries of the "scientific" worker or inventor were allowed to come within its beneficial influence. The scheme is for the organization and development of scientific and *industrial* research. Fertility of idea, discovery, and invention is not the sole property of the scientific worker. Some of the very best ideas, discoveries, and inventions have come from men who are technically skilled, or are daily in contact with the practical working of processes, but cannot claim to be scientists, except perhaps in a very limited and special sense, and maybe not even to that extent. Their ideas, discoveries, and inventions may be crude; but, scientifically developed, they may prove of vast material gain industrially and therefore nationally. Those men, though not able to lay claim to being "scientific," must, in the matter of protection, if they have recourse to the valuable help of the State-aided scheme, be on an equality with the "scientific investigator," the "scientific worker," and the "scientific

"inventor." If not, the very end that Professor Bone now chiefly desires will be quite frustrated—that is, to make the State-aided scheme a real serviceable factor in the development of home industries and of national prosperity, through increased economy and efficiency, and the opening-up of new processes and methods and the extension in good effect of old ones, with adequate reward and protection (even against piracy by foreign countries) for those with whom rests either the genesis or the development, or both, of new ideas. We do not think the limitation Professor Bone's frequent use of the word "scientific" conveys is intentional, unless it be with a desire specially to impress the cause of those who, through their position and environment, are less able to defend their own interests than the man who is associated with industry, and has easy access to private resources for assistance.

Working Experiences in Tar Dehydration.

THE subject of tar dehydration, or first-stage distillation, has entered into prominence in the gas industry as a matter of practical politics; and it is a branching-off into a (for the industry) relatively new process which is going to be largely extended in practice. There are a good number of these plants already in existence on gas-works; and there would have been a larger number still had it been possible to promptly obtain them. The fact that there is the prospect of very considerable expansion is not only in view of the requirements for the war, but because the process is acknowledged to be an economic one, which not only holds profit, but supplies the convenience of being able to meet the Road Board specification in relation to treated tars for road spraying and construction. With the prohibition, ruling during the war, as to selling untreated tar, many gas undertakings without dehydration plant, and many road authorities who require tar for road purposes, have found themselves in an unpleasant position—the former bodies because they could not supply the tar; and the latter because, the local supply being closed to them, they have had to incur the expense of going farther afield for tar, or alternatively have had to go without. Through this, and probably in part through the Road Board first conserving their finances, and now having those finances diverted into another channel, the past year has seen the country slipping back into more dusty highways, with the nuisance and discomfort that are promoted under the stimulus of modern traffic. The case is good all round for tar dehydration where a works is large enough; and as to the tar itself, it is now more amenable to treatment at the place where it is produced with heavy-charge carbonization than it was in the days of high-temperature light-charge carbonization, when, using some coals, there was in the tar an excessive proportion of water and free carbon. The change in respect of lower water content means for dehydration to-day lower fuel expense, and greater working capacity of the plant. This is illustrated by the differences that are found in treating carburetted water-gas tar containing a large percentage of water, and coal-gas tar containing only one-third to one-sixth the amount—the higher the water content, naturally the slower must be the travel of the tar through the still.

Therefore, the principle that tar dehydration is a proper thing for gas undertakings has been widely accepted—particularly since the "C" process came into operation for providing more toluol for the war; and already those who are experienced are discussing details. But the pious wish may at once be expressed that authors of papers on the subject would adopt some common basis in presenting working experiences and results, so that ready comparison could be made. There were two papers on the process read at the meeting of the Southern District Association of Gas Engineers and Managers last Thursday—one by Mr. Frank Livesey, of Maidstone, where a Wilton continuous still is in operation, and the other by Mr. R. Wardell, of Tottenham, where the "Hird" continuous process is in use. The other day there was also a paper by Mr. E. V. Chambers, before the Manchester Institution on the same topic. The three papers illustrate the point as to disuniformity in the rendering of data. Mr. Livesey, who already had a long experience with his plant, presents his temperatures all in degrees Centigrade, Mr. Wardell his in Fahrenheit, and Mr. Chambers kindly gives both in some cases, and unkindly only in Centigrade in others. It is, of course, easy enough to convert from one to the other for comparison purposes; but it is troublesome and a waste of time when the author could perform the service for all his readers. It would, therefore, be advantageous if authors would speak in degrees Fahrenheit in all communications on this subject.

Then, again, in showing the financial results—working expenses and receipts—it would be better if there could be something like co-ordination in their rendering. Admittedly, working expenses will fluctuate according to the scale of operation, the methods of working, the character of the tar with which the process has to deal, and time. Costs, of course, must be given as found, consistent with plant and local circumstances; but it would be better if they did not refer to a temporary period of extremely abnormal conditions. In the papers mentioned, we have two of the authors adopting very widely different values. Mr. Livesey takes the war price for coke of 30s. per ton; Mr. Chambers for coke breeze, only calculated on 10s. per ton; and Mr. Wardell leaves his readers to compute for themselves the details of his various charges from the total figures that he presents. This does not facilitate comparison. However, the discussion on the two dehydration papers presented at the Southern meeting was adjourned, as the members ran off to the consideration of the "C" process, and the subject of dehydration was hardly touched upon. In view of this postponement of discussion, it would not be a bad thing—seeing that different plants are dealt with by the two authors—if, before the next meeting, they would try to co-ordinate their tabulated data on a better basis for comparison. Then, again, Mr. Livesey's figures are for coal tar and carburetted water-gas tar mixed, which water-gas tar contains from 25 to 40 per cent. of water, and so raises the average. Mr. Wardell's figures are for carburetted water-gas tar alone, containing about 31 per cent. of water. It is necessary, therefore, in this matter to get details well in mind, before attempting to contrast the working results; otherwise the superficial consideration of figures may lead one very much astray. It behoves those who treat of this subject for information purposes to put the essential details as prominently as possible.

Most processes the results of which depend upon temperature conditions in relation to the material to be treated, which differs as does tar in composition, require very close supervision, in order to attain the best results; and with a dehydration plant every manager must, by experiment, under his own local conditions, make determination in this regard, guided, of course, by any pre-experience available. If only Mr. Livesey's paper were read, his experiences noted in connection with temperatures, and similar trouble were anticipated, it would probably deter many managers in a position to adopt a dehydration plant from doing so. Mr. Livesey's plant, however, was installed in 1911; and there has since been a good amount of independent work done to better adapt such plants to gas-works purposes, and to ease manipulation. But regarding temperatures, the papers must not be taken as giving any definite information for guidance under all circumstances. Heat economy is obtained in both systems described by a heat-interchanger, which enables the ingoing crude tar before reaching the still to extract heat from the outgoing tar. Mr. Livesey, in order to raise his ingoing tar to a proper temperature before admission to the still has introduced a steam-heater as an auxiliary to the interchanger; and, by this means, he is enabled to raise the temperature of the ingoing tar to 100° C. This is the "minimum" temperature advised by Mr. Chambers; but we find Mr. Wardell working with his ingoing carburetted water-gas tar at a temperature of 160° Fahr., although the water content is so high. Then Mr. Livesey finds that by working his still at 230° C., he can entirely denude the tar of all toluol. This is the temperature at which it is necessary to work in order to comply with the Road Board specification for tar-spraying purposes. But Mr. Chambers, on the other hand, states that the temperature should not be less than 260° C. (or 500° Fahr.) if the whole of the benzol, toluol, and phenol are to be removed; and Mr. Wardell agrees with this, although admitting that with a still temperature of 400° Fahr., "all the light oils, and most of the "phenols are driven off." Mr. Livesey, however, prefers, and does work at, a temperature of 220° C., as at the higher temperature he finds that the tar becomes extremely thick. There is thus some antagonism here between the Road Board specification and the condition of the tar working at the prescribed temperature of 230° C. Of course, as Mr. Livesey says, the tar could be thinned out by creosote; but this is now wanted by distillers for toluene extraction. He fears that, if the tar is not removed and used in cold weather with reasonable speed, it will be impossible to get

it out of the barrels or underground tanks. It is suggested, however, that, if the difficulty becomes acute, the creosote may be redistilled into two fractions, and the heavier be returned to the tar.

The question of temperatures in relation to the composition of the crude material and results is the chief one in this dehydration process, because there cannot be any standardization of exact temperatures applicable to all circumstances. However, the process is shown in the papers to be a profitable one; and it enables all gas undertakings to do locally what the road authorities require. There may be incidental difficulties with regard to the disposal of certain products. A new departure of this kind is, however, rarely without its accompaniment of troubles; but, as a rule, their subsidence comes with time and development. As Mr. Livesey points out, there are minimum limitations to the size of works that can adopt full tar distillation. This fact and the difficulty of disposing of certain products in the small quantities which some works would produce, directs attention to the question of the foundation by groups of undertakings of central plants for rectification and fractionation of the light oils and dealing with the dehydrated tar. This is a matter for the future. There is another point referring to the future. Mr. Livesey does not agree with those who say that, after the war, the demand for rectified products will be good and the prices high. "My own experience," he says, "goes to show that, in "normal times, the distillate produced is sometimes unsale- "able, and seldom fetches a price greater than that of dehy- "drated tar." Mr. Livesey bases his opinion upon past experience; but the normal times of the past may not represent normal *post*-war times. If one of the issues of the war is not a greater self-reliance of the country on home-made tar products, then the country will be inflicting a gross injustice upon itself. It is true that the production of tar is likely to increase. So will the population; so too will the home demand, and so too, it is hoped, will British exports. The standards of requirement of the past must not, and will not, be the standards of the future. Even in respect of explosives, the war has set up a new standard for national protection. We are not, therefore, prepared to measure the future by the past in this matter of tar products, and shall incline to look forward hopefully, and not pessimistically, in regard to it. A word or two more. There is entire accord with the last lines of Mr. Livesey's paper; so much so that they may be emphasized by quotation: "While it is un- "doubtedly the duty of every gas undertaking not to spare "itself to assist the Government in every way, it is only "right that the Government Departments should make it "their business to see that no excessive profits are made. "At the same time, the carrying-out of this patriotic work "should in every case be a source of a fair and reasonable "profit to the gas undertaking."

Gas-Fire Efficiencies—Thermal, Hygienic, and Ventilating.

THE low atmospheric temperatures of recent days have again turned particular attention to the practical application of gas to domestic heating purposes; and users, through personal comfort, extract considerable satisfaction from the fact that progress in gas-fire design and efficiency has been at such excellent rate during the past few years—progress due more to recourse to scientific aid and guidance than to anything else. The members of the London and Southern Junior Association last Friday evening were, therefore, appropriately occupied in listening to a lecture, which was constructive in the matter of new ideas concerning gas-fires and destructive in the matter of some old ones. Suffice it to say as a proof of interest that the lecturer was Mr. Harold Hartley, M.Sc., chief of the technical staff and laboratories of the Richmond Gas Stove and Meter Company. Some two years or so ago Mr. Hartley delivered a lecture before the Yorkshire Junior Association; and the present one puts us in possession of the development of views and information that has since taken place.

The lecture covered much ground—so much that it is only possible, apart from the publication of the full text in other columns, to touch here generally upon some of the topics composing it, and to extract from the remainder what are conceived to be the chief lessons of the new work to which attention is directed. In the first place, criticisms were advanced to be added to precedent ones with regard to the apparatus used in the Leeds test for gas-fires; special reference being made to the Rubens thermopile, which appears to be totally unsuited for this work. Then, touching more general matters, the lecturer levelled hard blows at former conceptions and some present practices in relation to the gas-fire. In, for example, discussing the hygienic standard, Mr. Hartley pointed out that the tendency to adopt a large flue-outlet is to be deprecated, as it neutralizes the advantage of the high canopy in a fire, and involves excessive thermal loss. We do not desire to depreciate hygienic efficiency in order to gain in thermal efficiency; but we do not want to lose thermally, if means other than the large flue-outlet (aided by other structural considerations) will preserve to the user full hygienic efficiency. Something as to Mr. Hartley's views upon this matter is obtained when he draws attention to the "Lancet" suggestion that, in connection with the test standard for hygienic efficiency, a length of 2 feet of flue-pipe should be used—that is to say, the elbow and a little bit more. The lecturer appears, however, to strike the mean, in performing the hygienic test, between a fire *minus* elbow and flue-pipe (unaided by chimney draught) and the "Lancet" suggestion of 2 feet of outlet-pipe, by submitting that, rather than have a large flue-outlet, the hygienic standard of test should be a fire standing in the middle of a room, but aided by a flue elbow, without any piping whatever.

It is pretty clear from this and what follows that the time has come when the construction of a gas-fire should be considered as a whole, and not construction for hygienic purposes receive consideration separate from construction for giving maximum thermal efficiency—that is to say, the bearing of hygienic efficiency, thermal efficiency, and ventilating efficiency the one upon the other should be studied; and the structural embodiment should be such as to secure the maximum efficiency in each regard, without the attainment of one form of efficiency adversely affecting one of the other forms. This point is accentuated when Mr. Hartley says (and we read it with some surprise) that the over-all thermal efficiency of the best type of gas-fire is only 60 per cent., through there being, practically speaking, no convected heat available. The explanation is probably this, that hitherto in gas-fire testing the radiant heat has been directly determined, and so has flue heat, and the balance has been assumed to be convected heat available for room heating. The assumption as to the balance being convected heat is quite justified; but the assumption as to the destination of the heat must, of course, depend on the location of the fire. It would only all be available for room heating if the fire stood out from the wall of a room with a flue independent of the wall. But if the fire stands on the hearth at the foot of the chimney, some of the convected heat must pass up the chimney, and not out into the room. It is easy to agree with the lecturer that it is better to have some convected heat in the room than to send thermal energy unnecessarily up the chimney—of course, assuming, as mentioned in the lecture, that the thermal energy cannot be realized in the radiant form. High thermal efficiency is essential for the universal adoption of gas-fires.

Following the course of the lecture, the ventilation question in relation to gas-fires is gone into in some detail; and it is seen that the experimental results have been subjected to mathematical analysis. The results obtained show striking agreement with the theoretical deductions; and this is where a strong case is submitted for the adoption of small flue-outlets (subject to the satisfaction of the hygienic standard), with subsidiary openings for ventilation purposes. At the end of the section of the lecture dealing with this subject, the conclusions with regard to ventilation are summarized; and these will well repay study. Fig. 3, too, is of special interest, as it indicates the very marked manner in which the volume of air actually passing through the flue-outlet may be decreased by proper attention to the relative sizes of the flue-outlet and the subsidiary ventilation openings; and it must follow, *primâ facie*, that the mode of ventilation that is adopted will affect the amount of the thermal energy transmitted to the chimney. In other words, it is necessary to keep down the thermal loss through the flue-opening as much as possible compatible with other essential considerations. It is also maintained that at least 80 per cent. of the possible ventilation can be obtained by ensuring that the resistance of the inlet to the chimney is no greater than the actual resistance offered by the chimney itself. It would, of course, be impossible to reduce the resistance of the inlet to the chimney to zero; and there would seem to be little advantage in increasing the inlets beyond the point which enables the 80 per cent. efficiency, in this respect, to be attained. The concordance between the experimental results and the theoretical equations for the ventilation is

strikingly shown in fig. 6, which, in our opinion, speaks well for the mode of experiment and for the deductions made.

Later in the lecture, the case for the more uniform distribution of the radiant energy emitted by a gas-fire is discussed, with special reference to the Richmond "R.H.D." fire. In connection with this fire, there was recently some controversy in our columns in which was raised the question as to the possibility of the escape of products of combustion through side draughts; and this point is analyzed. What Mr. Hartley says about the matter sums up what we consider to be the excellent case that the makers have at command upon this point. The broad survey made by the lecturer also includes considerations affecting the subject of the silent flame. It has been stated by some makers that the production of a silent flame depends upon the mixing of the gas and air. Experimental evidence in the lecture and the examination of the subject rather refutes this view, and suggests that the explanation is connected with the existence or non-existence of eddies in the gas stream. Even more important is the statement that the adoption of a high-temperature flame in a gas-fire does not increase the radiant efficiency of the fire. One is inclined to be carried away with the idea that local high temperature in a gas-fire radiant must involve increased radiant efficiency, as radiation from a hot body varies as the fourth power of the absolute temperature. A point that is frequently overlooked is that the adoption of a highly aërated flame does not necessarily involve an actual increase in the mean effective temperature of the whole of the radiant, nor does it ensure a decrease in the flue loss. The point is undoubtedly one of importance. In the concluding part of the lecture, an indication is given as to how a net gain of roughly 5 per cent. in radiant energy may be obtained with certain fires with proper attention to details.

These comments will give point to the general lessons to be extracted from the lecture, which, as already intimated, presents us with the results of work in continuation of that previously done and published. In carrying out this work, the Richmond Company have not only contributed to the advancement of their own interests, but to the general weal of the gas industry. Such work, we feel, ought to be recognized by those who are concerned with the manufacture of gas; for the experimental work involves the employment of skilled men and the expenditure of time and much else. In the case of this lecture, all the experiments, the results of which are embraced in it, were, it is clear, carried out, under Mr. Hartley's supervision, in the department of which he has charge. In saying this, we are sure that he would like us to draw attention to the acknowledgment at the end of the lecture of his sense of indebtedness to the loyal assistance of his staff.

Professional Salaries—The Inquiry Circular.

Some time since, protest was made by us, in the name of the gas profession, against the action of the Stoke-on-Trent Corporation Gas Committee in sending out an inquiry circular as to the rates of salary paid to the chief executive officials of other gas undertakings. There is a great difference between an inquiry of this kind, and one which has to do not with an individual—and he a professional man—but with a class of workers, such as stokers. The Directors of the Slough Gas Company are the latest offenders in canvassing for information as to the salaries paid to the engineers and managers of other gas undertakings; and protests against this have reached us from certain of those whose private business in this respect is the subject of their inquisitiveness. The Slough Directors would think it a piece of very bad taste and impertinence on the part of anyone who sought behind their backs exact particulars as to their own private incomes. What they would think of such inquirers, other people are to-day thinking of them. The object of the inquiry is in connection with an application for an increase of their own Manager's salary; and the Directors ought to be good judges of the justice of the application, without the aid of information from outside sources. The questions put are: (1) "Make of gas per annum; (2) salary of engineer and manager; (3) if any, and what, assistants; (4) if house, coal, gas, &c., free; (5) number of years' experience as manager." Regarding these questions, they indicate an idea that the recompense of a gas engineer and manager is something to be measured by very definite rule. It is nothing of the kind. The recompense of an engineer and manager should have relation to the value of his services to the undertaking. The question of the number of years of experience is not the chief consideration. Capacity is anything but a negligible quality; and capacity is not the exclusive property of those with years of service to their credit. We know of men of all years of experience in the profession—few years and many years—whose capacity is proved and undoubted. But capacity varies; and the capacity applied by an official to the affairs of a gas undertaking should be paid for. We do not say that capacity-*cum*-experience should be overlooked. However, let Gas Directors and Committeemen show their own capacity for administrative work by acting justly to their engineers and managers, and not treat them as though there exists a sort of settled market value for their ability and services as in the case of unskilled labour.

Coke-Oven Gas for Town Supply.

The development of the use of coke-oven gas for town supply in this country is proceeding slowly, but surely. Without mentioning small utilizations, Middlesbrough set the ball rolling; now Leeds has given the ball another effective push; and certain large Corporations last parliamentary session took power to enter into contracts for the purchase of such gas for supplementing their supplies. By what has been done at Leeds, past waste of good gas has been stopped at the coke-ovens of the Middleton Estate and Colliery Company, and has been brought into serviceable use, to the daily extent of 1 million cubic feet or thereabouts, in connection with the gas supply of the City of Leeds; and this has been proceeding now for about a month past with every satisfaction, as will be seen by the information courteously supplied to us, at our request, by Mr. W. B. Leech, the Engineer and Manager of the Corporation Gas Department. Thus waste has been converted into an economy; and while the Colliery Company are benefiting therefrom, it is quite certain that the Corporation Gas Department is also reaping advantage from a bargain with which an engineer and business man of such experience as Mr. Leech has had anything to do. The coke-oven supply is only equal to about one-fifteenth part of the maximum daily output of the Leeds Gas-Works; and this fact safeguards the city in the event of any temporary interruption of the supply. The gas is delivered to the Dewsbury Road works, through a steel main (details of which and the auxiliary plant are supplied in the article elsewhere in this issue), at a minimum pressure of 8 inches. The agreement as to supply contains protective conditions respecting quantity and quality; and concerning the latter, minimum candle power and calorific power and maximum nitrogen content have been specified. Payment for the gas is on a sliding-scale according to calorific power between 400 and 600 B.Th.U. This is another notable contribution to the forging of the chain linking together the gas-supply industry with the coke-oven industry.

Gas Appliances for Holland.

An esteemed correspondent in Holland sends a letter which is published in our "Correspondence" columns, and which gives a pressing invitation to British makers of gas-consuming appliances to cultivate the market offered by Holland for their wares. The efficiency of British makes is known in that country; and would-be users are waiting there with open arms for the manufacturers of this country to meet their requirements. The gas industry of Holland sees that the easiest road to the development of consumption lies through the best systems of gas utilization, not only in respect of domestic gas appliances but of industrial ones. Makers will be very hard-hearted, if they can resist the closing words of our correspondent's letter: "Make your British firms—all of them—understand that we wish to co-operate in every possible way in order to promote the beautiful system of heating with the modern British gas-fires."

Municipal Work in Birmingham.

The proceedings last week in Birmingham, in connection with the election of Lord Mayor, were of peculiar interest, from the fact that the choice fell on Alderman Neville Chamberlain—forty years after his father, Alderman Joseph Chamberlain, was elected for the third year in succession. Such an event invites reflection on the happenings in the interval; but there is little opportunity for that now. The present moment sees Birmingham changed from a hive of peaceful industry to one of the most important centres in the country for the production of munitions of war. The effects of this changed direction of

activity—which has, it may be pointed out, been accompanied by the departure of no less than 100,000 men from the city to join the Colours—have been generally felt, and not least by the Gas Department. The number of firms engaged on war work, and the fact that many of them are working day and night, has placed a heavy tax on the resources of the undertaking. For the first half of the current financial year, the output of gas showed an increase of more than 13 per cent. on that of the corresponding period of 1914; and the demand is still growing. This is a state of affairs which, as was recently notified in our columns, calls for the immediate provision of further carbonizing plant. In other directions much the same state of affairs exists; and the problems to be faced are many. With the urgent requests for economy, the city finds itself with an annual charge of £600,000 for interest, sinking fund, &c., £100,000 for dependants of employees who have joined the forces, and £50,000 for increased wages. Nearly one-half the Corporation staff who are of military age are with the Colours; and at least 10,000 persons in the city are rendering continuous war service free. Birmingham is doing much more of which there is good reason to be proud; and though the time is an anxious one, there could have been no more suitable occasion for the city to have as its head a member of a family who have so long been closely identified with its welfare.

Changing Conditions and Habits.

It is remarkable how kindly the public has taken to the darkened streets in London and elsewhere, and has soon adapted itself accordingly. The public realizes that the change is but a temporary expedient to mystify our unbidden nocturnal visitors, and that there is greater safety in the condition than if the marauders had below them a plan of city or town lined-out by gas and electric lamps. By contrast, the change intensifies (and the return from present conditions to the normal ones will do so still more) all the public has gained by the progress that has been made in the methods of street lighting, where these methods are applied. But the current conditions are the ones that immediately concern us. Gas and electric supply companies have been losing heavily, owing to the darkened conditions of the streets; and the loss has not been counterbalanced by the increased use of illuminants in the homes, where people stay after dusk much more than they did formerly. Habits have also altered; and the sole cause of this is traceable to the need for obliterating the streets as much as possible by the suppression of illumination by street-lamps, and of wayward radiations from the lamps of shops and residences. People do not at night time wander in the streets so much as they did formerly; the theatres and the music halls are less patronized; and the public caterers are not doing so well. It is a stay-at-home period. It, in effect, carries us back (as the "Daily Telegraph" said some few days ago) "to the era before gas was introduced into common use for street lighting, with the difference that the population of London is far larger and more widely dispersed than it was. Dickens, Thackeray, Kemble, and Dr. Johnson would feel quite at home in the streets in these days, though they would miss the linkmen and marvel at the motors. They might be surprised at any suggestion that the times were out of joint; things would look normal." But we have altered our ways since those revered worthies paced the paved ways in and about Fleet Street.

Shopping Hours Reduced at the Dark End.

Another habit of many people that has been changed by force of circumstances, is that of putting off shopping at the big emporiums until daylight fails. The night attractiveness of these places has been depreciated by the rigorous measures taken to suppress the escape of light from windows and doorways on to the roadway; and the shaded lamps within are not the best aids to the efficient conduct of business. Quite a number of the largest of the shopping establishments in London have decided to close earlier—one as early as five o'clock, and several at six o'clock. It is stated that the considerations that have led to this decision have been the safety of the public and the enabling of assistants to reach home at a more reasonable hour. We are not sure, but it would not be surprising, if this new experience does not result in a permanent adherence to earlier closing in the important trading centres of London—it would certainly produce an economy for the proprietors of the shops if the public ratified the action by producing business compensations in the daylight hours. Those people who patronize the large establishments in London are not those in poorer circumstances who are often unable to shop until the evening time, and then make their purchases at less imposing shops. But these changes in shopping hours and requirements, which produce economy in lighting accounts, of course hit the suppliers of illuminants very hardly, as do also the changes that have been made in other directions—for instance, in the hours and customs applying to licensed premises. But in the gas industry there have been innovations of a more revolutionary character; and they have been successfully surmounted. At the same time, the loss of business in "lumps" in one direction requires a lot of work in other directions to secure a counterpoise. Fortunately, in the gas industry we have more diversity of application of the primary commodity, cheaper installation and upkeep, and greater economy than our chief competitor can boast of; and so the enforced reduction of lighting patronage is more easily encountered by the one industry than by the other.

Joint Enterprise in Tar Distillation.

We believe that the question of joint enterprise by gas undertakings in the matter of working-up the residual products of gas manufacture will receive extended consideration, and that the idea will materialize. It is not a new subject in our columns, and only recently ["JOURNAL" for Nov. 2, pp. 241, 261], it was revived by Mr. E. V. Chambers, in the paper he contributed to the last meeting of the Manchester Institution. Mr. Chambers hinted that he knew of gas engineers who were deliberating over the matter of putting-down central plants for the rectification and fractionation of the light oils from tar dehydration plants at gas-works, as well as for treating the dehydrated tar. There have been many complaints—and particularly lately since tar-washing came into use, and the quantities of light oils in the tar were considerably increased—that some tar distillers have not been acting justly by gas undertakings. A special article dealing with the increased value of the treated tar was not long ago contributed to our columns, and is worth keeping in view [see "JOURNAL" for July 20, p. 120]. This action of certain of the tar distillers in pocketing an undue share of the increased value serves to enhance the reason why gas undertakings not in a position to have a complete tar distillation plant of their own, should group themselves together for the provision of a central plant. Two or three of these about the country would help those who are anxious to buy the crude material from gas-works to a better appreciation of the desirability of acting fairly.

The Precedent of Germany.

We are not in the habit of depreciating our own country. But in some industrial and commercial matters, it must be conceded that Germany has set us a good example. In the provision of central tar plants by gas undertakings, that country has been before us. Mr. G. S. Hessenbruch has been attracted by the German plan; and so included particulars of it in a paper he recently read before the Missouri Public Utilities Association We have shown on previous occasions that in Germany the gas undertakings do a large amount of co-operative dealing in coal and residual products. In his paper, Mr. Hessenbruch relates how the majority of the gas-works are members of an organization known as the Verband Deutscher Gas Fabriken; and how the gas undertakings have subscribed the capital with which the Association have constructed the necessary plants for dealing with tar and ammonia. The plants are built on a conveniently central site, and of a size determined by the aggregate raw material contributions of the group of gas undertakings. The quantity sent by each gas-works is recorded, and the quality tested, and due note is made of this, and the undertaking profits accordingly. The central plant is run as an organization distinct from the gas undertakings; and from a central office control is kept of all the plants, as well as of the stocks of materials and transactions. This control promotes economy in dealings, and in the transit of the finished materials. The gas undertakings, in addition to the payments received for the crude materials, as determined by quantity and quality, receive (we take it) interest on the capital subscribed to the Association. The gas undertakings are allowed to do just as they please in this matter. There is no saying: "You must not do this, and you must not do that." They do what is best for their undertakings; and through the undertakings, the consumers of gas benefit, as well as those who participate in the profits of the gas concern.

CAPTAIN RICHARD B. G. GLOVER KILLED.

AMONG the latest casualties on the Western Front, is unhappily included the name of Captain Richard Bowie Gaskell Glover, 1st (City of London) Battalion the London Regiment (Royal Fusiliers), who was killed in France on the 5th inst. Captain Glover was in his 32nd year, and was the younger son of Richard Thomas Glover (late Chairman of Messrs. Glover and Main, Limited) and Agnes Glover, of Bryntirion, Dartmouth Park Road. He was educated at the U.C.S. Preparatory School, Holly Hill, Hampstead; Doon

House, Westgate-on-Sea; and Uppingham School. He was a school "prepositor," in the Rugby Fifteen and the Hockey Eleven, and became head of the Cadet Corps. When he left Uppingham, he obtained his Commission in the Royal Fusiliers (T.F.), and volunteered for Imperial Service at the beginning of the war. After five months in Malta, he was sent to France with his regiment. He was a member of the Rosslyn Park Football Club, and a Liveryman of the Worshipful Company of Haberdashers. His Commission as Captain was gazetted in March, 1907, when he had passed the School of Instruction.

His Colonel, writing of him, says: "I would like you to know how much we all loved him. I have known him ever since he joined the Battalion; and the charm of his personality and character, his keenness and strong sense of duty as a soldier, will never, never be forgotten by those of us who knew him and loved him. Oh, he was such a good fellow; and I am sure that there is not a man in the Battalion who does not grieve at his death."

The deceased officer was a popular member of the "Evening Star Lodge," where he was initiated into Freemasonry in 1912.

IN MEMORIAM—M. DELAHAYE.

APPROPRIATELY to the first anniversary of the death of M. Adolphe Philibert Delahaye, which falls on Dec. 3 next, an eloquent tribute to Delahaye's genius as technical authority, journalist, and administrator has been published by his colleagues of the Syndicat Professionel of the Société Technique. It takes the form of a *brochure*, briefly recalling the inestimable services rendered to the gas interests in France by Delahaye up to the day of his death.

It is fitting that this appreciation of the talented General Secretary of the Syndicat Professionel should be associated conjointly with the two great French bodies, for Delahaye's incessant labours embraced a wide field. He was a technician of the first rank, but, unlike many technical experts, possessed a mind singularly alive to the problems of business organization, and intensely interested in promoting their solution. The monograph now issued does not perhaps add any facts of Delahaye's life to those mentioned in the notices of his career which appeared in the "JOURNAL" immediately after his death.* But this later tribute does lay special emphasis upon the high esteem in which Delahaye was held in many circles into which he was brought during his twenty years of active work for the gas industry. It is recalled that his interest in lighting sprang from his connection, when about thirty years of age, with several electrical publications. He had invented an eleetric lamp, or, strictly speaking, a regulator, prior to that of Jablochkoff; and the Exposition of 1881 had caused him to turn his attention particularly to electricity as a source of light, on which subject many extremely able articles appeared from his pen during the next few years.

The time was one in which the gas industry in France was feeling the necessity of girding itself for a struggle with a possible rival. The Directors of the "Journal des Usines à Gaz," established in 1876, were then seeking to appoint an Editor competent to represent the industry and to deal with the changing technical conditions consequent upon Siemens' publication of the principles of thermal recuperation in flames. Attracted by Delahaye's lucid treatment of most complex subjects, their choice fell upon him. He accepted the position in 1885; and from that time onward to the day of his death his energies were wholeheartedly devoted to French gas interests. The mere recital of the posts which he filled is enough of itself to mark the important place he occupied. In addition to the direction of his journal, he filled in succession the chief official positions in the Société Technique du Gaz. On the establishment, in 1892, of the Syndicat Professionel, he became its General Secretary—a post which he retained until his death. In this capacity he spared neither time nor labour in bringing the Syndicat to its present high degree of usefulness to the industry, although for ten years his services were entirely honorary. In addition, he did a great deal of work as an expert for the tribunals of commerce of the Seine; undertaking important duties in litigation, an arbitration connected with electrical competition, damages by explosion, and claims, often unjustifiable, by municipal authorities. His conclusions in connection with improper concessions for electric lighting have been employed as the basis of legal administration; while in a notable case of litigation arising out of alleged damage by electrolysis, it was he who drafted the tests to be made in such circumstances for fixing the liabilities of the respective parties. Work of this engrossing kind did not, however, prevent him organizing the gas sections of the Paris Expositions of 1889 and 1900, nor from acting for years as General Secretary of the International Committee of Photometry.

Amid all these duties, as the memorial *brochure* relates, Delahaye had never allowed himself any relaxation from business—at least, not until the year 1910, when his health for a time gave way. His return to his work at the Chambre Syndicale was made the occasion of a demonstration by his colleagues of their profound regard for him by the presentation of a gold *plaque*. The incident greatly affected M. Delahaye, whose tastes, in the phrase of the oration delivered over his grave, were "*eloignées de tout apparat.*"

The last five years of his life witnessed his old activity, save for his retirement for a month each year to his country estate. Germany's declaration of war, we read, caused him physical distress—not at the call of his two sons to the colours, but from the vividness with which he realized the commercial and industrial upheaval in public and private life which a long war would bring. Yet he never lost confidence, nor once left Paris. He had the joy of seeing his younger son completely recovered from wounds received in the early months of the war, and of having himself contributed to the organization of the gas industry for the supply of munitions.

To these records of efficiency, however, must be added the tribute to M. Delahaye's personal qualities. His colleagues write in the warmest terms of his universal and overflowing goodness, of his great sympathy, and of the integrity and disinterestedness which characterized his manifold labours in the different branches of the industry to which he was devoted.

* Vol. CXXVIII., pp. 590, 654.

Masonic—Evening Star Chapter.

After the transaction of the ordinary business of the Evening Star Chapter 1719 on Wednesday last—including the election, as joining members, of Ex. Comp. A. E. Croager, the W.M. of the Evening Star Lodge, Ex. Comp. Thomas A. Guyatt, and Comp. E. J. Fox, and the exaltation of Bro. Charles Clare—the Principals and Officers for the coming year were elected as follows:—

M.E Z.	Ex.-Comp.	Frederick A. West, P.Z. 1602.
H.	„ „	W. Thomson.
J.	„ „	Arthur E. Eves, P.Z. 1201.
Scribe E.	„	Rae P. Normand.
Treasurer	„ „	W. A. Surridge, P.G. Std. Br., P.Z. 1719, 1201, 1397.
Scribe N.	Comp.	William Dommett.
P.S.	„	A. E. Broadberry.
First A.S.	„	F. W. Cross.
Second A.S.	„	George Hands.
Organist	„	C. W. Offord.
Stewards	„	A. C. Beal.
	„	W. R. Silk.
	„	Arthur Valon.

Recovery of Sulphur Dioxide.—The "Engineering and Mining Journal" says that sulphur dioxide may be recovered from gases comparatively poor in it (according to a United States patent No. 1,145,579), by passing the gases at room temperature—say, 11° to 24° C—over charcoal, when the SO_2 is absorbed, and later heating the charcoal to from 130° to 180° C., when the SO_2 is expelled. The enriched gas, which, the inventor states, may occasionally carry even 98 to 99 per cent. of SO_2, is recovered and used. He also calls particular attention to the fact that various charcoals have different affinities for sulphur dioxide, and particularly recommends the use of boxwood.

PERSONAL.

Mr. H. Barton, A.S.A.A., has been promoted to the position of Accountant to the Aldershot Gas, Water, and District Lighting Company.

Mr. A. M'Alpine, Assistant Manager at Maybole, has been appointed Manager of the Aberfeldy Gas-Works. There were over thirty applications for the post.

At last week's meeting of the London County Council it was reported that Mr. L. W. S. Rostron had, owing to ill-health, found it necessary to resign his seat on the Local Government (No. 3) Committee, of which he had for some time past been Chairman.

Mr. John Wilson (son of Mr. Alexander Wilson, of Glasgow), who is at present Assistant Engineer at the Falkirk Corporation Gas-Works, has been appointed Chief Technical Assistant to Mr. James MacLeod, the Engineer of the Greenock Corporation Gas Trust.

Owing to the resignation of Mr. W. H. Nutter, the Engineer and Manager of the St. Annes-on-the-Sea Gas Company, on account of ill-health, Mr. E. Hargreaves, his Assistant, has been appointed to succeed him. Mr. Hargreaves has been in the service of the Company for many years, and for the last eight years has assisted in all departments.

Out of thirty-five applicants, Mr. Thomas H. Nield, who is now Resident Manager of the Hollinwood Gas-Works, under the Oldham Corporation, has been appointed Manager of the Hebden Bridge and Mytholmroyd Gas Board. He succeeds Mr. E. J. Wellens, who has secured the vacant post at the Grimesthorpe (Sheffield) Gas-Works. Mr. Nield, who is 36 years old, commenced his career in the head office of the Oldham Corporation Gas Department, where he received his commercial training. For 8½ years he has been engaged in general works' management; and during the past two years he has been Resident Manager at Hollinwood. During this period the works have been practically re-modelled; and Mr. Nield has assisted in supervising the erection of the largest spiral-guided gasholder in the world, a complete installation of vertical retorts of two million cubic feet per day capacity, new purifiers, &c.

ELECTRICITY SUPPLY MEMORANDA.

Some representatives of the electric supply industry at one time tried to make capital out of an occasional gas mishap. Gas-ovens used to be illustrated exploding, with Mary Ann, cutting a very undignified figure as she was making exit (at considerable velocity and inconvenience to herself) through window or door.

Frightfulness.

Rooms looking like scrap heaps were also portrayed as having been put into that condition by explosions of gas, and as being a frequent condition of homes in which gas was used. The public laughed at all such nonsense; and statements and illustrations did no harm whatever. The public is wise enough to appreciate that, with care, there need be no accident with gas; and it has also realized the fact that electrical accidents, which frequently result in death, are covered with too much mystery to be pleasant. Now "Meteor" naturally forgetting that the "Electrical Times" was ever so stupid as to have had anything to do with fomenting the use, by electric undertakings, of the form of "frightfulness" referred to above (which, when applied, left the public unperturbed), now says: "The day is long past when competitors of electric lighting could frighten householders by tales of live conductors and the slaughter of innocent children." We are not aware that gas undertakings ever made use in their local trading literature of tales of "live conductors and the slaughter of innocent children," though there is not the slightest reason why "innocent children" should not be slaughtered by electricity as well as innocent men—as a matter of fact, there are incidents on record of malfeasance on the part of electricity in connection with which children have been among the victims. But we go on to read that "even the 'fusing of electric wires,' we think, falls on dull ears nowadays. The public easily swallows a brand new lie, but will only yawn at an old one." Then electric wires do not fuse. They never have done so. To say so was at one time "a brand new lie;" now it is "an old one." This is very curious. There is something wrong between our recollection and experience and "Meteor's" assertion. Next we shall have the Germans saying that they never sank the *Lusitania* with its multitude of innocent men, women, and children aboard, nor that they have ever sent Zeppelins to London to indiscriminately murder men, women, and children, and to wreck private property and homes.

Trouble with gas is a comparatively rare occurrence; death due to electricity is a pretty frequent happening. Of course, "Meteor" may choose to say that this is also an "old lie." He may call it just whatever he likes; but people are really not such asses as to fail to recognize facts, even when an electrical writer is pleased to wrongly classify them. There was a soldier killed recently by electricity at the Military Camp at Richmond, as the result of a "practical joke," which should have been described as a "murderous joke." Within the month of October, there are on record at least five deaths due to electric shock. Early in the month, T. E. Green, aged 24, an employee of the South London Electric Supply Corporation, Limited, was found lying over a live wire, with his clothes on fire, in one of the cells into which he had gone to dust the insulators. Death resulted from shock and syncope due to the burns. A little later, at the works of the Lancashire Ordnance Company, Heaton Norris, a workman received a fatal electric shock. A motor was being lifted with chain blocks; and one of the chains came in contact with a cable running on an insulator close by. At the point of contact with the cable, the insulation had worn away. The pressure was said to be about 286 volts. Near the same time, E. M. Jackson, an electric lamp trimmer, in the employ of the Islington Borough Council, climbed an electric arc standard to trim and recarbon the lamp. He suddenly fell from the top of the lamp to the ground. Both hands of the poor fellow were found blistered. At South Shields during the month, Horace Smith, employed by the British Electric Arc Welding Company, came in contact with some live metal, and was found unconscious with a V-shaped burn on his neck. Towards the end of the month, an Italian—Matteo Simeone—was killed at a restaurant at Neath. A brass rail ran round the counter; and this rail was connected to an electric wire, with the idea of producing fun at the expense of anyone who happened to touch the wire. Simeone caught hold of the rail; his feet at the same time came in contact with an iron plate in the floor; and a circuit was established. Simeone will never again be a party to any practical joking with such a dangerous fluid as electricity. It was stated at the inquest by an electrician (Mr. J. Wesley Evans) that the voltage in the supply mains was 220; but 30 volts was the maximum obtainable where deceased fell. Then it is reported that, on Oct. 31, at the Military Hospital at Richmond, through an electric cable fusing, one nurse received burns and another had a severe shock. How would "Meteor" describe these occurrences? As "lies"? Perhaps the true meaning of the word has escaped his memory.

Facts—Not Lies.

Electricity consumers never will understand the principles—there are a great number of them—on which charges are made for electricity; and, therefore, the professors of mathematical accuracy in formulating tariffs (the rateable value one, for example) had better save their time, and give up as hopeless all attempts at making consumers appreciate the soundness of their proceedings in this regard. The electrical profesion started their tariff-making work with a fair show of reason for utilizing in it a heavy batch of factors. But they had to forsake the righteous way which they had planned, and renounce scientific rule, in order to obtain heating and cooking custom—irregular, and helping to form peaks and declivities in the day output curve—by charging ½d. and 1d. per unit for current so used. The load factor and all else had to go by the board in order to do this. Then came the rateable value system, which finally rejected all principles and factors, made trading in electricity nothing short of a gamble, and inflicted upon consumers all sorts of irregularity in their payments for the service rendered—causing in some cases charges per unit in excess of the maximum, and setting up in others a system of preferential treatment in defiance of the statutory regulation. The tariffs of the electrical industry supply the results of a most unhappy and confused mixture of effort, and a confession of the trading conditions in electricity being irreconcilable with a sensible and plain system of charging. Householders have been asked by Mr. Asquith and others to economize; and electricity consumers are economizing among other people. One such lately wrote to a morning paper, complaining of the conduct of the electricity company supplying his house. This frugal one has been saving every pennyworth of current possible; and the company have put in a claim for the minimum charge of 13s. 4d. per quarter—equal to 20 units at 8d. They are within their legal right (as was lucidly explained by Mr. Runciman when the matter was raised recently in the House of Commons); but the consumer, in consequence, cannot see what is the good of complying in this particular with the appeal of Mr. Asquith and the economists, if 13s. 4d. a quarter is to be paid to the electricity suppliers although current is not consumed to that amount. One morning contemporary sought out an electric lighting official for an explanation, and that worthy admitted that some electricity consumers "are cutting-down their bills so low that it is not worth while supplying them." He gave the obvious advice that the consumer can change from an ordinary to a prepayment meter, or he can cease to take a supply for the present. If such consumers do not pay the undertaking through an ordinary meter, they will not do so through a prepayment one. Anyway, those householders who find a grievance in the minimum charge for electricity should be informed that in the trading of the gas industry there is no minimum charge; business being conducted on the same lines as in other commercial transactions—the charge made being for only the gas consumed, and not for a cubic foot more or less.

Tariffs and a Minimum Charge.

Practically throughout the electricity supply industry, charges have had to be increased, owing to abnormal circumstances resulting from the war. The legal contributor of the "Electrical Review" has been discoursing on the subject of the powers that exist in relation to the making of the increased charge. He is against municipal suppliers trying to foist upon the

A Legal Opinion.

ratepayers the additional costs occasioned by the war. This legal contributor knows something about equity; and he sees the Local Government Board standing at the junction from which diverge the right and wrong ways in this matter. "The fact that 'profit,' so-called, was written off against the rates in the piping times of peace is not likely to persuade the Local Government Inspector to make the ratepayer pay the loss accruing owing to the war." There is a nasty sting about the words "profit, so-called." Many electricity supply undertakings, as we have previously pointed out, have taken the short cut to making compensation for increased costs by adding from 10 to 20 per cent. to all accounts. A sudden percentage increase, he says, cannot be legally defended as a way of reducing losses; but notice must be given to each consumer that, at the end of his current contract, he will be charged at the added rate—the operation being then perfectly legal, provided all consumers are treated alike. "No preference" must be shown "to any consumer or class of consumers." Thus the lighting rate must be raised uniformly in the district, and the power consumers, as a class, must also be similarly treated. He refers to the maximum prices allowed by the special Provisional Order, and adds: "So long as the statutory limit is not exceeded, electric supply undertakers—whether local authority or company—may charge what they like by agreement." To this may be added that it is subject to the provision as to no preference being shown, and the observance of the one as to "like circumstances." The Long Eaton, Ilford, and South London cases gave the electricity industry some valuable lessons in legal interpretation.

Salvation of the Electric Lighting Business.

"Lux" has been writing for the "Electrical Review" an article headed "Half-Watt Lamps from the Central Station Standpoint." The article also deals with matters other than the half-watt lamp; but, when treating of the new comer, the truth is not told in ascribing to it an efficiency of 1 candle power per half watt. It is said that "a 2000-candle power half-watt lamp . . . consumes 1 KW." If it is a 2000-candle power lamp actual, it consumes more than 1 KW.; if a lamp only consumes 1 KW., it is not of 2000-candle power. Beyond this, the mean spherical candle power of the lamps is 20 per cent. below the nominal candle power, which is measured on the horizontal. However, "Lux" is anxious to administer comfort to the central station engineer over the coming of the half-watt lamp. The metallic filament lamp has been the salvation of the electric lighting business; for all the old and foully slanderous broadsides that used to be directed against gas, could not have prevented people from preferring economy to the heavy claims on the pocket that the carbon filament lamp made through its gross inefficiency. The metallic filament lamp came just in time to prevent a fearful slump in the electric lighting business. But central station engineers then shivered. Here was a lamp which gave a candle power (say) for 1·5 watts per hour, against 4 to 5 watts by the carbon filament lamp. Then came the half-watt lamp in large and medium sizes. Again the central station engineers shivered. They see a rapid decline in consumption. But they are asked to be of good cheer. The half-watt glare projector fills a vacant space between the ordinary metallic filament lamp and the flame arc lamp. People, we are told, like it for advertising purposes. Its economy will secure large new adherents. Its economy, too, makes it possible to use the lamps with indirect or semi-direct fittings, and obtain the same illumination at the same cost, as with the bare metallic filament lamps. Central station engineers need no longer shiver. They must look at these things in the true perspective. With the new lamps, "Lux" assures the engineers, everything is going to blossom in the lighting line for electricity, to the disadvantage of other illuminants. Of course, things are not going to be quite as smooth sailing as that; there are other points besides the single one of current consumed. But it is excusable to omit mention of them when the idea is to show that all is well with the electric lighting business in relation to the central station output.

Heat Losses.

"Lux" shows that the electrical process is a prodigal one in squandering heat units right away from coal heap to lamp or heater; and this fact he thinks indicates that there is plenty of scope for further raising the efficiency of electric-lamps. Electricity stations must live; and it is probable that, if there is any more efficiency gained in electric lamps, this will have to be added to the other factors which have fallen upon the concerns—increased cost of coal, apparatus, fittings, labour, rates and taxes, and so forth—and help to advance the charge that the undertakings have to make per unit for lighting purposes. However, the figures are interesting that "Lux" gives as to the heat inefficiency of the electricity system. Here they are: "Of the full energy equivalent of the coal pile, only about 70 per cent. reaches the inlet valve of the turbine in the form of steam. About 80 per cent. of this energy is lost in converting it to mechanical power, so that we are left with about 14 per cent. of the energy of our coal pile available at the turbine shaft. The efficiency of converting mechanical to electrical energy and distributing the latter is very high, so that we still have 10 per cent. of the energy of the coal pile available at the lamp terminals. Of this, carbon filament lamps convert only 2 per cent. into light, while metal lamps convert 6 per cent. into light, and the half-watt lamps convert some 10 per cent. of the energy into light."

Heating at 2d. per Unit!

An optimistic "Wholesale Supplier" of electric-heaters has been writing to the "Electrical Review" on the subject of the attitude of local authorities towards electric heating. We are told by this disinterested person that electric heating is becoming more and more universal throughout the country; and he is surprised to find any local authority going out of their way to retard its progress. The effect of this policy must be felt by the local contractors, the wholesale suppliers, and the manufacturers. The optimist goes on to say that he is convinced now that coal is at such a high price, and the gas authorities intend to raise their charges still more per 1000 cubic feet (we had not heard of this before), that "electricity even at 2d. per unit can make it worth while for the ordinary consumer to instal an electric fire." We are glad "Wholesale Supplier" pitches his ideas no higher than one electric fire in view of the 2d. per unit. We hope he will go on siding with the 2d. per unit; and that other electrical people will follow his example. There is not much business in electric heating at ½d. per unit—not even with the new incandescent bar fires. Quite a lot of electricity per hour has to be consumed in very cold weather in an ordinary room to make one feel a proper degree of comfort. Continuous heating by electricity may suit the pocket of Lord Tom Noddy, but not of ordinary individuals.

SULPHATE OF AMMONIA FOR WHEAT.

In the course of a letter which appeared on p. 324 of last week's "JOURNAL," explaining the arrangements which have been made between the Board of Agriculture and the Sulphate of Ammonia Association, by which manufacturers will reserve a supply of manure for autumn top-dressing, Mr. D. Milne Watson (the Chairman of the Association) stated that the Board were issuing immediately a pamphlet recommending farmers to use sulphate on wheat. Copies of this [Special Leaflet No. 46] are now obtainable on application to the Secretary, Board of Agriculture and Fisheries, No. 4, Whitehall Place, S.W.; but it is intimated that the President of the Board has appointed a Committee to make arrangements for the supply of fertilizers, and farmers who have any difficulty in securing supplies of sulphate of ammonia at the agreed price should communicate with the Secretary of the Committee at No. 3, St. James's Square, S.W. The arrangement come to between the Board and the Sulphate of Ammonia Association is that the reserved supply will be sold during November and December at prices not exceeding £14 10s. net cash per ton f.o.r. at the makers' works, in bags, in lots of 10 cwt. and upwards.

As to the advantages of this top-dressing, the Board, in the leaflet, remark that experiments at Rothamsted may be accepted as sufficient to establish that, if prudence be exercised in applying nitrogenous manures, so that they are used on suitable soils and at proper times, there is good reason to anticipate an increase of one sack [240 lbs.] of wheat per acre as the result of an application of 1 cwt. of sulphate of ammonia in the late autumn, and a further increase of one sack per acre as the result of an application of 1 cwt. of sulphate of ammonia or 1⅓ cwt. of nitrate of soda in the spring. On this basis, they make an interesting calculation. There are now 2 million acres under wheat in this country; and assuming that the crops on about a million acres are suitable for top-dressing, and that the season proves moderately favourable, the application of nitrogenous manures as described would result in the addition to the 1916 crop of a million quarters of wheat. This being so, they point out that, if applied with discretion, the profits from dressings of 2 to 2½ cwt. per acre of a nitrogenous manure, partly in autumn and partly in spring, should be substantial; and at the worst, in the event of the coming harvest year proving very unfavourable, there is not likely to be any considerable loss, with good judgment and proper application.

The leaflet, which states the case for autumn top-dressing well, concludes with a number of suggestions as to quantities of manure for an acre of land, for the guidance of those who intend to use sulphate of ammonia in the manner referred to.

Labour at Power and Light Works.

It has been brought to the notice of the Minister of Munitions that the working of many munition factories is being imperilled by the difficulties now being experienced by gas companies and electric supply companies, which provide them with power and light, in retaining a sufficient staff for their immediate needs. The Minister desires to point out that such companies are engaged upon work of vital importance, and that the removal of their employees, even to munition work, may frequently have the effect of prejudicing the output of munitions of war. He would at the same time invite employers to assist him in the matter by refraining from attracting labour from these essential undertakings.

The death occurred on the 11th inst. of Eliza Harper, widow of Mr. Joseph Bennet (Messrs. Alder and Mackay), of Edinburgh. Deceased was buried yesterday, in Morningside Cemetery.

The Council of the Institution of Civil Engineers announce that—starting with to-night—the time of the ordinary meetings will, owing to possible disorganization of traffic in present circumstances, be changed temporarily from 8 p.m. to 5.30 p.m.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS & MANAGERS

THE General Meeting of the Association was held last Thursday, at the Hotel Cecil, Strand, W.C., under the presidency of Mr. J. W. AUCHTERLONIE, of Cambridge. Probably in view of the papers on the dehydration of tar and the informal discussion on the "C" process, there was an extraordinarily large attendance of members.

LOSSES TO THE INDUSTRY.

The PRESIDENT said, before starting the proceedings, he thought he ought to briefly refer to the loss the industry had sustained by the death of two very prominent members. He referred to Mr. Edward Allen and Professor Vivian B. Lewes. Mr. Allen was a member of the Association; and, by reason of his many visits to London, he was frequently able to attend their meetings. He was in that room only at the last meeting; and he then took part in their proceedings with his usual vivacity and keenness. He was in the forefront of the *personnel* of the industry; and his counsel was always very much appreciated at any of the meetings of professional organizations. Professor Lewes was an eminent scientist, an able chemist, and a great authority on gas manufacture, as well as, as they were all aware, on the processes of industries of many other kinds. He (the President) thought they all looked upon Professor Lewes as a personal friend; and certainly, with his commanding presence, his charming personality, and his wonderful fluency as a lecturer, he was at once an education and a joy to listen to. In the name of all the members, he thought he could say that they mourned the loss of these two gentlemen. The Hon. Secretary had already sent a message of sympathy with Mrs. Allen; and he (the President) thought the members might wish to show their respect for these two departed ones, and at the same time support the action the Secretary had taken, by silently rising in their places.

This was done.

MINUTES.

On the suggestion of the HON. SECRETARY (Mr. H. C. Head, of Winchester), the minutes of the last meeting were taken as read.

ELECTION OF OFFICERS.

Mr. A. E. BROADBERRY (Tottenham) said it afforded him great pleasure to propose as President for 1916, Mr. W. Doig Gibb. [Applause.] He was sure it was unnecessary for him to make any lengthy remarks to recommend Mr. Doig Gibb as President. The applause that greeted his name showed how well he was respected by the whole of the members; and it was sufficient to say that the members felt, while they were doing Mr. Gibb the biggest honour in their power, they would be appointing a gentleman as President who would reflect a great deal of honour on the Association itself.

Mr. J. WESLEY WHIMSTER (Bath), in seconding, said he was sure the Association were honoured by having such a man as Mr. Doig Gibb as President. They knew that he would uphold the dignity both of the office and of the Association.

The PRESIDENT congratulated Mr. Gibb upon his return to better health.

The motion was cordially passed.

Mr. DOIG GIBB (who was received with applause) thanked the members very much for the honour they had done him electing him as President. A month or two ago he had very grave doubts as to whether he would accept the office; but pressure was then brought to bear upon him by the Committee, and their kind words of encouragement decided him to accept the position. He only hoped that he would be able to keep up its high traditions and, when it came to his turn to congratulate his successor, that he would be able to turn over the office to him as solid as he himself would take it from Mr. Auchterlonie's hands.

Mr. D. H. HELPS (Reading) proposed that Mr. W. N. Westlake be elected Vice-President, and remarked that he was certain that when that gentleman came to fill the higher position, he would do so with dignity and advantage to the Association.

Mr. P. P. CHANNON (Hayward's Heath) seconded the proposition, which was unanimously carried.

Mr. W. N. WESTLAKE (Exeter), in replying, said there were times in one's life when one felt grateful for compliments that were paid to one. He thought he ought to feel more than usually grateful for the honour the members had done him. Though he entertained some considerable doubt as to whether he should fill the office as Vice-President to the satisfaction of the members and of the generous friends who persuaded him to accept it, he would do his best. No man could do more. When he came to his year in higher office, he hoped the members would be completely satisfied.

Mr. W. H. BENNETT (Redhill) proposed, and Mr. P. DREWETT (Farnham) seconded, the election of Mr. Frank Livesey as a member of the Committee.

Mr. F. W. CROSS (Lea Bridge) moved, and Mr. W. B. FARQUHAR (Ilford) seconded, the election of Mr. A. A. Johnson (Brentford) as a member of the Committee.

Both proposals were heartily carried.

Mr. C. F. BOTLEY (Hastings) proposed, and Mr. THOMAS PRICE (Walton-on-Thames) seconded, the re-appointment of the Hon. Auditors (Messrs. J. L. Chapman and A. Dougall).

This having been agreed to,

On the proposition of Mr. W. E. PRICE (Hampton Wick), seconded by Mr. L. TREWBY (Mill Hill), Mr. Head was re-appointed Hon. Secretary and Treasurer.

The HON. SECRETARY acknowledged the continued confidence of the members.

ADDITIONS TO THE MEMBERSHIP ROLL.

The HON. SECRETARY then read the names of the new candidates for membership: Mr. Cyril Towers, of Hythe; Mr. H. J. Randall, of Yorktown; Mr. J. Taylor, of Weston-super-Mare; Mr. W. E. Dean, of Exmouth; Mr. L. H. Eady, of Southampton; Mr. J. W. Whimster, of Bath; Mr. G. C. Offord, of Petersfield; and Mr. J. H. Donaldson, of Sevenoaks.

The PRESIDENT moved that these additional eight gentlemen be elected members.

Mr. ARTHUR VALON (London) seconded the motion; and it was unanimously carried.

REPORT OF THE COMMERCIAL SECTION.—THE WESTERN DISTRICT.

The HON. SECRETARY said it was hardly worth while taking up the time of the meeting in reading the report of the Commercial Section. He was going to hand a copy of it to the Technical Press to print with the "Transactions" of the meeting. He should, however, like to allude to the accounts. During the year, the section had very nearly paid its way. It had reduced its balance by £2; but this was more than accounted for by the donation of ten guineas to the Prince of Wales' Fund. Before concluding his short announcement, he should like to make mention of yet another matter, which came before the Association and the Commercial Section, but it appealed to the latter more than to the former. In September last, the Committee had before it a letter signed by Mr. James Armstrong, of Ilfracombe (a member of the Association), in which it was suggested that several members of the Southern District Association, resident in the West of England, were desirous of having a Western District Commercial Section. A Sub-Committee was appointed to deal with the matter, and a meeting was held at Exeter, at which it was decided to recommend that the Commercial Section do hold quarterly meetings in the western portion of the southern district. The members for whom Mr. Armstrong wrote were very emphatic that they did not wish to sever their connection with the existing Commercial Section; and it was felt the course recommended was the best method of meeting their wishes. It was understood that this method commended itself to western members. The members of the Commercial Section should make this known as widely as possible, and so ensure for the meetings in the west an unqualified success as soon as they commenced.

The report of the Committee of the Commercial Section was as follows:—

The Committee have pleasure in submitting the sixth annual report of the section, for the year ended Sept. 30, 1915.

Membership.—During the season one member has resigned, and two have joined; the total number of members now being sixty-three.

General Meetings.—Twelve general meetings have been held during the season; the average attendance being sixteen members.

Coal.—During the period under review, the questions of supplies and prices have, owing to the war, given cause for anxiety. At one period, the position of many companies became, owing to depleted stocks and congestion of the railways due to Government requirements, so perilous that strong representations were made to the Government for assistance. This, due largely to the good offices of the Railway Executive, was forthcoming. Seaborne coal was practically unobtainable, and then only at greatly enhanced prices. This promptly re-acted on the Yorkshire and other fields, and increased prices all round.

In the autumn of 1914, the prices ruling were about 1s. per ton below the prices at the corresponding period in 1913; but later the figures very materially increased—up to 5s. and 6s. per ton. The reasons given by the colliery owners for such large increases were, the restricted output owing to miners joining the forces, the increased cost of production, and the advanced rates for seaborne coal.

With a view to curtailing the unwarranted inflation of prices, a Bill was introduced into Parliament, limiting the increase in the price of coal at the pit's mouth to 4s. per ton over 1913-14 prices. The Bill became an Act in July last; and under it buyers who were being charged in excess of the limit could appeal for a reduction in the sanctioned prices. The desirability of lodging such appeals had been a matter of much consideration and discussion; and many buyers have thought it undesirable to take advantage of the Act.

Coke.—At the commencement of last winter, fairly large coke stocks were held at many works, prices were accordingly low, and large quantities were sold forward. The shortage of coal in the winter, however, made a great demand on coke; and high prices were obtainable. Companies holding large stocks unsold were amply repaid for their forbearance.

The Committee note with great regret the incompleteness of some of the fortnightly returns, and must urge all to make regularly complete returns, and fulfil their obligations to their fellow members.

Tar.—In order to secure to the Ministry of Munitions all the light oils, &c., from the tar produced at gas-works, orders were issued to all

road authorities that only dehydrated tar should be used for road purposes. This prohibition placed many companies who were not in possession of dehydration plants and who usually sold their tar for road purposes in a very awkward position, both in the matter of storage and finance; the disposal of the tar at a much reduced rate to the distillers being in some cases rendered necessary. Since the order came into operation, many dehydrating plants have been ordered; but the delivery of these is being greatly delayed owing to the demand for direct Government requirements. The Ministry is, however, taking steps to secure the delivery of plants on order without further delay.

Sulphate of Ammonia.—Since the beginning of the war, there have been opportunities for introducing this fertilizer into overseas markets which were previously obtaining supplies from Germany. No effort will be spared by the Sulphate of Ammonia Association to establish the English product in these markets; and there is little doubt that they will succeed, provided the British product is of a higher standard. The desirability of a guaranteed 25 per cent. of ammonia is urged.

A scheme is on foot for regulating the sale of sulphate of ammonia in the country districts by fixing a minimum price for farmers and dealers in each area. This, it is felt, will do much to assist undertakings in disposing of their sulphate of ammonia locally. Those undertakings which are not already members of the Sulphate of Ammonia Association are strongly advised to join. Apart from any other reason, the increased price which the Association has enabled sulphate of ammonia makers to obtain repays the subscription many times over.

The Board of Agriculture intend making during the autumn and spring strong representations to farmers in the British Isles to use sulphate of ammonia, in order to increase the production of cereals and other food stuffs. The Sulphate of Ammonia Association has been approached with a view to fixing prices at works for sales up to the end of the year. It is hoped the efforts of the Board of Agriculture will prove a success.

British Commercial Gas Association.—The Committee feel that there is nothing futher to be added to the appeal contained in the last report; but they are happy to be able to state that during the past year the names of several companies in the South of England have been added to the already long list of subscribing undertakings. The British Commercial Gas Association is carrying on its valuable work in a most satisfactory manner; and the use of such an Association has never been greater than at the present time. Any member who is connected with an undertaking which does not already belong to the Association is asked to use his best endeavours to secure its support.

War Service Badges.—This subject was discussed at more than one meeting; and at the request of certain members orders were placed by the Committee for a supply. This was before the issue of official badges to munition workers. It is now understood that the private badges issued under authority are withdrawable under the terms of the Munitions of War Act, 1915; but notice under the Act has not been issued by the Ministry of Munitions.

Numerous subjects have been discussed from time to time at the meetings—among them being: Price of light oils, wages at works, &c., discounts on steam tubes, price of B.O.V., badges for gas-works' employees, slot installations, coal supplies, tar for road treatment, war bonuses, coke contracts, retort carbon, &c.

Signed on behalf of the Committee,

H. C. Head, *Chairman.*

October, 1915. R. Seymour Tobey, *Hon. Sec.*

Mr. Westlake moved the adoption of the report; and, Mr. D. T. Livesey (East Grinstead) having seconded, the motion was unanimously carried.

Education of Gas-Fitters.

The Hon. Secretary reported, in relation to the question of the examination of gas-fitters, that a copy had been received from the City and Guilds of London Institute of the report of their Examiners. This report, which it was hardly necessary to read to the meeting, would be printed in the "Transactions." Speaking generally, the report indicated the necessity of the better education of gas-fitters. The thanks of the Association were due to the various members who kindly assisted the Association by acting as Examiners for the practical tests, or appointing assistants to act in that capacity. Most of these gentlemen had kindly consented to act again next year. The City and Guilds of London Institute stated that examinations would probably be held next spring in the following towns: Norwich, Newmarket, Exeter, Wandsworth, Salisbury, Cambridge, Ilford, and London. At the request of the City and Guilds of London Institute, letters had been sent to the managers of the gas companies in various towns asking them to arrange that classes in gas-fitting be held in their respective towns during the ensuing winter. In some cases, this has been possible; but in others, owing to the present conditions, managers had not found it possible to comply with the request. The gentlemen who consented to act as Examiners were:

Norwich	Mr. W. H. Wayte, British Gas Light Company, Bishop's Bridge, Norwich.
Newmarket . . .	Mr. J. H. Troughton, Gas-Works, Newmarket.
Exeter	Mr. F. Caudwell, Gas-Works, Exeter.
Wandsworth . .	Mr. H. A. Wall, Gas-Works, Wandsworth.
Salisbury . . .	Mr. N. H. Humphrys, Gas-Works, Salisbury.
Cambridge . . .	Mr. H. Sword, Gas-Works, Cambridge.
Ilford	Mr. F. Ainsworth, Mr. H. S. Collister, Mr. T. Hurry, } Gas-Works, Ilford.
London	Mr. J. Hewett, 39, St. Asaph Road, Brockley. Mr. S. B. Chandler and Mr. H. Baldry, South Suburban Gas Company, Lower Sydenham. Mr. P. J. Smithers, Gas Light and Coke Company, Horseferry Road. Mr. B. W. Brooks, Gas Light and Coke Company, 146, Goswell Road, E.C.

Two Papers on Tar Dehydration.—See pp. 373-7.

Two papers were then read—one entitled "Some Notes on the Working of a Continuous Tar Dehydration Plant," by Mr. Frank Livesey, of Maidstone, and the other "Notes on Tar Dehydration," by Mr. R. Wardell, of Tottenham. It was proposed that the discussion on them should be taken together with the private informal discussion on the production of toluene which was on the *agenda*. This was done; but the remarks almost entirely related to the latter subject, and those few which touched solely upon the papers cannot well be separated from the remainder. Among the speakers was Mr. F. L. Halford, of the High Explosives Committee, who put forward the point of view of the authorities regarding the gas industry and the war. At the close of the discussion,

The President said he was afraid the discussion had rather drifted away from the papers. He would ask Mr. Doig Gibb to propose a vote of thanks to the authors.

Mr. W. Doig Gibb remarked that it was a pleasurable duty to propose a hearty vote of thanks to the readers of the two papers which formed an excellent introduction to the interesting and lengthy discussion they had had upon the all-important question as to the best way to help on the war. Their thanks were equally due to the other two gentlemen—Mr. W. D. Child and Mr. Frank Durkin—who had been kind enough to prepare papers for the meeting. He was sure they were too patriotic to feel any resentment on account of their papers having been crushed-out by the discussion on toluol. He had every sympathy with them on the postponement of the papers, because it would make his own task the easier when preparing the programme for the next meeting—seeing that the papers were already in print, and it would be unnecessary to get promises for them. [Laughter.]

Mr. A. E. Broadberry (Tottenham), in seconding, said that the discussion they had had on the subject of toluol extraction and tar dehydration had been so interesting that they had all been thoroughly engrossed in it. If the readers of the other two papers felt any regret at not having had an opportunity of submitting them to the meeting, he was sure the members generally also regretted not having had the pleasure of listening to and discussing them. Personally, he had been much looking forward to these papers, and was glad to think it was only a pleasure postponed.

The vote of thanks was then put to the meeting, and carried by acclamation.

The Two Remaining Papers.

The references by Mr. Doig Gibb and Mr. Broadberry were to two other papers which had been prepared for the meeting, but which there was no time to present—on the "Construction of Concrete Purifiers at Romford in 1913," by Mr. W. D. Child, and a "Short Description of the Carbonizing Plant at Southampton, and Results Compared with Previous Years," by Mr. F. Durkin, of Southampton.

The President said it had been suggested that the two papers still on the *agenda* should be taken at the next meeting. It was felt that this would be the better course, as they were well worthy of discussion. He would be glad to know whether the members agreed to it.

Mr. F. W. Cross (Lea Bridge): I suggest that they should be circulated before the meeting.

The President: There is no reason why we should not do that.

Mr. W. E. Price (Hampton Wick): May I suggest that it might be possible perhaps to arrange for the discussion of the other two papers also to be taken at that meeting? I am sure some members would have liked to discuss them to-day who have not been able to do so.

The President: That can be considered.

The proceedings closed with a cordial vote of thanks to Mr. Halford for his presence at the meeting, and for the information he had given them.

Disguised German Mantles.

Under the heading "Flying False Colours—German Gas-Mantles show the Stars and Stripes," last week's issue of "John Bull" remarked: The 'cuteness of the German trader is beyond question; and he is as impudent as he is artful. We have an example in front of us. It is a square cardboard case, used in the packing of gas-mantles. Three sides of it are occupied by as many representations of the American flag—the stripes in red and white gaiety, the stars in sober blue and white. And across each flag are the two words, "The American." The object, plainly enough, is to conceal the true origin of the gas-mantles. Closer examination reveals, on the bottom of the cardboard case, the words (in very small, unobtrusive type), "British Patent;" and we have to own, on the principle of giving the devil his due, that the words "Made in Germany" appear on the side of the case. They are not printed, but are added with an india-rubber stamp, as though by an afterthought. The whole intent is to deceive, and it is cleverly done; for the "Stars and Stripes" of "Old Glory" make a most effective design, though probably the people of the United States would not be proud of this misuse of their national banner. The article is in good condition, and looks like new stock. We learn that these German mantles, passing under the American flag—as do other things Teutonic—have been, and are being, used by one of the large gas companies.

COKE-OVEN MANUFACTURERS' ASSOCIATION.

Meeting in Sheffield.

The First General Meeting of the Association was held in the Hall of Applied Science, Sheffield, on Saturday, when the business was an address by Mr. GEORGE CHRISP (the President), of the Dalton Main Colliery, on the "Development of the Bye-Product and Coking Industry of Great Britain."

Mr. CHRISP said that in this present time in the history of the country it might be thought that the energies of the industry ought to be devoted entirely to the problems of the present rather than the past. The Council of the Association, however, had thought, with him, that they should have some data put together in view of future use. There was no doubt that a history of the industry would have to be produced some day; and an address of this description, embodying a careful collection of data, so far as had been possible, would be expected to arouse a certain amount of discussion, out of which might be expected to come some additional data for the help of the future writer, whoever he may be, of a proper history of the industry. In the present conditions, such data were being rapidly lost, and a serious effort must be made to preserve them.

The author pointed out that the beehive oven is really a bye-product oven—its bye-product being waste heat for steam raising. This oven is acknowledged to be still the producer of better coke from some coals than the retort, though the retort-oven is able to coke certain coal that the beehive cannot use. The early progress of the new oven has been slow—perhaps due to the fact that abundant supplies of fine coking quality coal are available in this country, whereas abroad the beehive oven is unable to deal satisfactorily with much of the low-coking grade coal found. By the use of the retort-oven, with outside quenching appliances, the heat of the walls is retained, so as to make full use of the small quantity of fusible elements present.

Clovis Knab, a French engineer, designed the first retort-oven, and erected a battery in 1856. In 1861, Henry Simon (the founder of Messrs. Simon Carvés, Limited) became interested in Knab's oven, and, in conjunction with F. Carvés, introduced side heating flues. The early difficulties experienced with coke users were not confined to prejudice; but gradually improvements were effected in the quality of coke produced, and the rising prices of bye-products assisted to arouse interest. Attempts were made by owners of beehive sets to adapt their plants to meet developments by the recovery of bye-products. Aitken in Scotland, and Jameson in England, made moderately successful efforts in this direction, by a system of perforated conduits or "grips" in the floor of the oven, through which the products were drawn and recovered. The introduction in 1883 of Simon's recuperator was a distinct improvement; and this type was largely adopted in this country, with modifications, for nearly twenty years. The vertical flued regenerative oven then began to assert itself. Coppée had built vertical flued ovens in Belgium as long ago as 1861 and here in 1873; but the Otto Company appear to have been the pioneers of the modern oven of this type.

After detailing the relative advantages and disadvantages of regenerative and non-regenerative types of ovens, Mr. Chrisp added that the decision of firms in choosing the type most suitable for their purpose is largely influenced by their particular requirements in waste heat or live gas for power and lighting. He then described the various ovens, commenting upon their outstanding features, and referred to the introduction of the compression machine by the Simon Carvés Company in 1900, and by Semet-Solvay shortly afterwards, to the improvement in the coke produced (in the way of higher yield, &c.). Mention was also made of various improved coke-handling arrangements, and a description given of the early practice in ascension-pipes, mains, and circulation, and the evolution of present methods therefrom.

After this, Mr. Chrisp came to the subject of ammonia recovery, the development from the "indirect" to the "direct" system, and a description of intermittent and continuous methods of treating liquors. He alluded to Bolton and Wanklyn's patent of 1882 for direct ammonia recovery, and stated that Koppers "semi-direct" process was the one from which the present "direct" methods have been evolved. He then described Mackenzie's patent of 1914*—oxidizing the sulphur compounds to SO_3 by means of oxides of nitrogen + steam = H_2SO_4, which reacts on the ammonia in the gas to form $(NH_4)_2 SO_4$.

The vital importance of benzol recovery was emphasized; it being remarked that the intermittent process is now almost discontinued, the continuous system being capable of higher yields, by minimizing losses in circulation. A *résumé* of progress made was followed by some comments on the evolution of the coke-oven manager, his adaptability to changing and progressive conditions, &c., the need of the new Association, and the opportuneness of the present time for the movement.

Mr. Chrisp added that the coke-oven industry was being conducted in England before it was in Germany; the first plant in this country being at Port Clarence, Middlesbrough. In a brief reference to Durham coal, he mentioned that he remembered having one sample of this coal which produced coke weighing 57 lbs., but which, with a compressed charge, produced 80 lbs. of coke on the same size of coal. If there were any members who could correct him with better data which could be introduced into the address for future reference, the Council would welcome such corrections. They desired to place the historical part of the Association upon a good basis.

Mr. T. B. CARR remarked that, in regard to direct recovery, Mr. Chrisp had spoken of Koppers being the originators of this system. He assumed, of course, that the speaker had meant in England. He believed Branck was the first on the practical scale in Germany.

Mr. CHRISP agreed that this was so, so far as his own knowledge went.

Mr. T. H. RILEY, referring to the stamper at Monkton, said this had been started about 1900; the machine having been ordered from Germany three years before. It was of the first type, and many times it broke down. To continue making charges they had had to have wooden mallets, and do the whole of the stamping by hand.

The PRESIDENT remarked that it was very interesting to have among them that evening, in Mr. Riley, the man who had actually been the first to be in charge of the first machine of this kind in this country.

Mr. F. COOPER said the President had said something about the first ovens in this country being at Stillington. There was an old installation of bye-product ovens at Micklefield. He was wondering if this had not been the first.

The PRESIDENT replied that the Micklefield plant was not a success, owing chiefly to the unsatisfactory nature of the coal, both from the coke and the bye-product points of view. There had been no tar worth speaking of, but a curious yellow oil. This plant was begun in the year 1885.

The HON. TREASURER (Mr. B. W. Haigh), in proposing a hearty vote of thanks to the President, said he thought the Association had made a very excellent beginning, not only from the point of view of the *personnel* of the President, but of the number of members whom they had already gained in association with them. He understood there were about 104 coke-oven plants in the country, and for their membership to number half of the managers spoke well of the prospects of the Society. They seemed to have, indeed, come into being at a most opportune moment. The Government, he thought, was never so much inclined to recognize the industry as at present. It was undoubtedly regarded as a very important industry at such a juncture in the history of the country. There were certain modern developments of the industry to which the President had not referred; it was impossible to include every phase in a half-hour address. The development of power at collieries was one important feature where coke-ovens were now being used. The gas-engine feature was an important one; and very large installations of gas-engines were now, and had been for some time past, successfully at work, producing a considerable proportion of power at the collieries. He did not think he was giving away any secret in saying that a million cubic feet of gas per day was now being supplied to the Leeds Corporation by a certain coke-oven plant in their area. Another highly important point which they should bear in mind was to see that the products they turned out were all of the very best quality. In years gone by, there had been complaints—not without justification—that the sulphate produced in the English works was not equal to that manufactured in Germany. By means of hydraulic extractors and other methods, he believed most English works now turned out a sulphate which contained 25 per cent. of ammonia. Mr. Chrisp had referred to the importance of producing every possible ounce of benzol, and he (Mr. Haigh) believed the Council had already arranged for the Association to have, in the near future, a paper on this subject. He did not think he was wrong in saying that at the present moment the highest source of toluol for high explosives was the coke-ovens. He believed all the benzol now produced was being used for the manufacture of synthetic phenol, which was turned into picric acid for explosives. He understood that no benzol was now allowed to be used for traction purposes.

Mr. J. MARSHALL seconded the proposition, and said he could not but admit that he had learned a few things from the address, despite his own years of experience in the coke-oven world.

The motion was carried unanimously.

The PRESIDENT, in replying, said it had been a very real pleasure to him to get out the data for the paper. In doing so he had found a good many things he did not previously know himself. [Laughter.] The difficulty of getting reliable data had been very great. The information supplied to him by the various coke-oven companies had been so extraordinary that he had had to get it out in lumps. He would still welcome criticism or correction if any members would care to write to him. They, as an Association, would some day be asked to furnish a history of the coke-oven and bye-product industry.

* See "JOURNAL," Vol. CXXXI., p. 403.

Occupations from which Enlistments Should be Restricted.—The Board of Trade announce that an inter-departmental advisory Committee are engaged in preparing lists of reserved occupations—*i.e.*, occupations from which enlistments should be restricted, in view of the necessity of maintaining the trade of the country as far as possible. Representations from employers with reference to indispensable and irreplaceable classes of labour should be addressed to the Secretary, Reserved Occupations Committee, Board of Trade, Gwydyr House, Whitehall, S.W.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A well-attended meeting of the Association was held last Friday evening, at the Westminster Technical Institute, Vincent Square, Westminster—Mr. S. B. CHANDLER (of the South Suburban Gas Company), the President, in the chair.

DEVELOPMENT IN GAS-FIRES.

The business consisted of a lecture, by Mr. H. Hartley, Chief Chemist to the Richmond Gas Stove and Meter Company, entitled the "Development of Gas-Fires, 1913-1915." The lecture [which will be found in full on pp. 382-8 of this issue] was illustrated by lantern slides, and various practical demonstrations; and one of the firm's "R.H.D." bow-fronted fires was in operation on the platform. The author dealt with his subject in an extremely lucid manner, and the members gave their closest attention to all he said and did.

The PRESIDENT, in introducing the lecturer, pointed out that his reputation was of the best; and the members were justified in anticipating something good from him as the result of the great amount of research work that he had done. At the conclusion of the lecture, he remarked that the Association were honoured by the presence of Mr. Thornton, the Managing-Director of the Richmond Company; and perhaps he would be good enough to say a few words.

THE GAS INDUSTRY AND CAPITAL RESTRICTIONS.

Mr. H. M. THORNTON said he should have preferred first of all to hear any observations on the lecture that members might have to make. It was, of course, rather difficult for him to criticize the lecture; and he did not think that he should try, even if it appeared to him desirable. Mr. Hartley had traced the history of gas-fire construction during the last few years; and it must be obvious to all those present that a very great deal of important work had been done in the laboratories of gas-stove manufacturers. Possibly the amount of this work had surprised many of the members. The stove-makers were very modest; and what they did, they seldom spoke about. [Laughter.] Even if they did speak about it, they did so in such terms that not one of them in the business seemed to know what the other meant. But leaving all this aside, one could not fail to be struck by the different position occupied to-day by what was called the "trader"—he did not think it was a nice word—in relation to the professional element in the gas industry. The change that had come over the whole scene in this respect the last five to ten years—the desire manifested to co-operate, to work together, but to go ahead as one complete body—had been one of the most pleasant features of the industry. They could safely say that the breaking-down of this barrier—which he hoped would never be replaced—had been of vital importance, and splendid in result to the whole of the industry. The members had heard what his firm had been doing in their own particular works; and he hoped they had been interested in the facts which the Company were glad to have had an opportunity of bringing before them. Perhaps they would pardon him if he broke away from the lecture for a moment or two, to touch upon another very important subject. Unfortunately, the country was at war; and possibly it was likely to be for some time to come. What was the position of the gas industry to-day? They had just heard of the wonderful changes in gas-fire construction, which had brought them to the time when they could go to the consumer with perfect confidence and place a gas-fire in every room of the house, knowing that the result was going to be satisfactory from every point of view. Thus they had a splendid opportunity for obtaining new consumers; and in a pamphlet issued by the Parliamentary War Savings Committee the public had been asked to use more gas. Why? Because in this way they would produce the very materials which were needed for the successful prosecution of the war—particularly the toluol which was employed in the manufacture of high explosives. As he had said, they were told in this pamphlet to use gas; but unfortunately they were not told how to raise the funds to provide the requisite apparatus to carry out to its fullest possible extent this very sensible suggestion. The Treasury, on the one hand, said: "You must not raise capital;" the Parliamentary War Savings Committee, on the other hand, said: "Please consume as much gas as you can." Statements had appeared in the Press lately with reference to a deputation (which arose out of a letter he wrote to the British Commercial Gas Association), who waited upon Lord Moulton's deputy on the High Explosives Committee. The deputation was received with every cordiality, and great appreciation was shown of the facts adduced. The position on this point, therefore, was being considered; and they hoped for a satisfactory result with regard to obtaining sanction to raise funds for the purpose of buying apparatus. Some gas undertakings were fortunate in being provided with capital; and therefore they were able to go on as usual.

THE QUESTION OF RECRUITING.

But he thought that an industry with millions of capital at stake, like the gas industry, which was also of obvious importance to the prosecution of the war, required to be put on a proper basis with regard to a very much more important factor. Assuming that they had the money, their men were leaving their employment willingly to join the fast-swelling ranks of the army. They were all proud that it should be so, and that the industry was taking so splendid a part in the national crisis. But they were now coming to a point at which they required a decision. Perhaps it might be thought that he was speaking selfishly; but what was right for the manufacturers was right for the industry as a whole. They could not separate themselves. What he asked for was guidance on the point of how far this recruiting in connection with the industry was to proceed. He believed the matter was under consideration; but he wanted to know, if the men were essential in the works where gas was made, were they essential further on than this? Were they essential to the fitting of the apparatus? and essential to the manufacturers of the apparatus? Was it desirable from the point of view of the country that these men should give up their employment? Guidance was needed; and the matter was of such importance that he ventured to refer to it now, although it had nothing to do with the lecture. If they knew it was necessary for the men to go, they would all, he was sure, be willing to make the utmost sacrifice. But they were told the country was short of toluol, and more gas must be made and sold; and they could not do this if they lost the men for the manufacture and fitting-up of apparatus. As time went on, they would find more men gradually leaving; and a period might arrive when the gas consumption would go down, and when they might be left in a very difficult position with regard to the production of essential war materials.

GAS-STOVE CONSTRUCTION.

He was afraid he had not added very much to the discussion; but he did feel that they had arrived at the point in gas-stove construction when many of their friends would exclaim: "Defend us from any further alteration." But he did not think the time had come yet when they could stay their hand. It was a most fascinating subject; and the work that was being done with regard to research on the construction of fires and other apparatus was obviously not going to cease yet awhile. In fact, he did not think it would be to the interest of the industry that it should do so. They had to provide apparatus which would be the most satisfactory to the consumer, if they were to retain their position. By doing this, they would ensure a great future for the industry to which they were proud to belong.

A VOTE OF THANKS.

The PRESIDENT said he was sure they all thoroughly appreciated what Mr. Thornton had said. He had put the case for the gas industry very clearly. They had heard a brilliant lecture from Mr. Hartley, who must be regarded as one of the first of gas research men. He had no doubt to some extent upset a good many of the theories held by members with regard to gaseous heating. Probably some of them had had the idea that almost any modern gas-fire would give them at least 75 per cent. efficiency—roughly, 50 per cent. in radiant heat, and 25 per cent. of convection. This, for one thing, had been rather upset.

Mr. W. A. VANNER (Walton-on-Thames), in proposing a hearty vote of thanks to Mr. Hartley, said the lecture had been full of interest from beginning to end. They all fully appreciated the thoroughness with which he and the Richmond Gas Stove and Meter Company had put before them the results of their scientific investigation.

Mr. F. C. BRIGGS (Gas Light and Coke Company), who seconded, remarked that one had gained during the last few years notions about the gas-fire which had been knocked on the head by Mr. Hartley. The lecture would be most valuable; and they would ponder carefully on the points brought out. In this way, they would learn a good deal more from it than from a lecture which simply confirmed what most of the members might already believe.

Mr. HARTLEY, in acknowledgment of the vote (which was accorded with acclamation), said he had only touched upon work which had actually been done in the firm's own laboratories; and it bore in all its aspects, he thought, on the developments of the last two years. There was represented in the digest that he had given them a very large amount of research. It would be perfectly obvious to them that he, as an individual, had not done all this work, and the thanks they had given him were in part due to his staff, because it had only been possible by their aid to collect and interpret the facts which had been put forward in the lecture. In addition to the loyalty of his staff, he was much indebted to the firm under whose auspices he worked for the opportunity of investigating these problems so thoroughly. In a manufacturing concern, when one started out upon an investigation, the work could be split up under two heads. One was out to attain a certain object. One wanted to find the "how," and having done so, often had to stop. But it was very hard to stop at this point, because one's training made one want to know the "why." In this ventilation problem they had tackled, he thought they had been perfectly conscientious in striving for the "how" and the "why;" and it was for this reason he had felt particular pleasure in the opportunity of expounding the work to the members. He was glad to have provided food for reflection; and he hoped it would not be thought—and he did not believe it would—that his object had been to expound the firm's particular make of gas-fires against any other patterns. He had tried to explain his firm's reasons for their designs; and where they had clashed with other views, he had stated why these other views had not been adopted.

MIDLAND JUNIOR GAS ASSOCIATION.

Opening Meeting of the Eleventh Session.

It has already been mentioned that the Association have been compelled, by force of circumstances, to arrange a much shorter programme than usual this session; and of the few meetings that it is intended to hold the first took place on Saturday afternoon. in the Technical School, Suffolk Street, Birmingham—Mr. F. J. WARD (of Knowle), the President, in the chair.

OFFICIAL CHANGES.

The PRESIDENT, in opening the proceedings, said that, as the members were aware, Mr. H. E. Stone, who was Treasurer of the Association, had left Birmingham to take up a position at Birkenhead. The Council had congratulated him on his new appointment, and wished him success in his future career. Unfortunately, they had also lost Dr. Davidson, who had been a tower of strength to the Association. He was always ready to give them of his best. Whenever the Association required special information on any subject with which Dr. Davidson was familiar, he was pleased to give it. He had left the gas profession for another extremely important industry; and while regretting losing him, their very best wishes went with him.

A SHORT ADDRESS.

The PRESIDENT then addressed the members shortly; pointing out, in the first place, that when he delivered his Presidential Address a year ago, he did not at all anticipate being requested to continue in office for a second term. Events had, however, conspired to render such a course, in the opinion of the Council, desirable. The curtailment of the programme had been rendered necessary owing to the impossibility of asking members to prepare papers, or arranging for the Association to be received at works as visitors, at a time like the present, when every member was fully occupied in performing his part in providing, light, heat, and power for the community—a task which was, of course, made heavier by the absence of such a large number of gas officials with the Colours. The members of the Association had responded gallantly to the call for service; upwards of thirty being now with the Forces. Unhappily, too, they had to mourn the loss of a very promising member, in Second-Lieutenant E. W. Blenkinsop, formerly of Leamington and Warwick, who fell nobly doing his duty. While hoping they would not lose any more members in the same way, they were quite sure all would be equally ready to meet the call if it came.

Turning to works topics, he remarked that, though the extraction of toluene from gas was being successfully prosecuted generally, it was not possible for all works to undertake it by the usual process—particularly those very small ones which were unprovided with an exhauster and the necessary plant. In the case of works which possessed only sufficient apparatus to deal with the extraction of ammonia, it was obviously impossible to carry out toluene extraction without providing and fitting-up additional plant—a difficult thing to do in these days of labour shortage. Increased expenditure of motive power was entailed by the working of a toluol extractor; and in his own works he could not adopt the process until he had laid down a larger engine—the one in use being barely sufficient for other needs. Should toluene extraction be undertaken with insufficient washing plant, resulting in some ammonia being unextracted, where oxide of iron revivification *in situ* by the air process was practised (in which case there was always a quantity of free oxygen unutilized passing forward from the purifiers), the problem would arise of considerably increased oxidation of service-pipes and iron internal house pipes. He was himself trying to discover how to avoid this difficulty, which was accentuated when the meters used were wet ones; the rust being then damp, and difficult to eject from the pipes.

The supply and price of coal was giving them serious concern; and unfortunately the Act which was hurriedly passed to limit the price was practically a dead-letter. If it were possible to force the coalowners to accept the prices laid down by the Act, they certainly could not, without legal resort, make them keep up those supplies, or maintain them at the required quality. It was a truism to state that the less competition there was in the sale of coal, and consequently the higher was the price paid, the less regard had the suppliers for keeping up the quality. In times of bad trade, the coal received was always of good quality—being better screened, washed, or picked than at other periods. The present times were having a very varied effect on the sale of gas in different localities. Where the military were stationed, or where munitions were manufactured, there were considerable increases in sales, and in some cases difficulties from lack of labour and plant were being experienced; while in almost entirely residential districts like his own, decreases were universal. Lessened public lighting, earlier closing of premises, change of habits of consumers, and general economy, were all having their effect; and increases in the prices of cookers, fires, fittings, &c., tended to prevent their increased use. They must wait patiently for the clearing of the horizon, for regaining lost ground and securing fresh business.

Continuing, the President said the improvements which had been made within the last three or four years in the method of burning gas in fires, had caused a large increase in this line of business; and the recent adoption of silent burning was one of the greatest forward steps made. There remained, however, many points which could be improved upon. The radiants usually had horizontal or inclined bars and an upright stem in front, which seldom became white hot, and therefore detracted considerably from the appearance of the fire. Were these removed, leaving only side and back stems, with horizontal or inclined bars and larger studs, the appearance would be much enhanced. The bogey of unconsumed gas, through flames playing on obstructions, was of no account, as in two or three minutes combustion was complete, when the studs became heated. A hotter flame than was usual with the newer burners was also necessary, to cause a better glow. In connection with fires, he referred with pleasure to the circular fire introduced lately by Messrs. R. J. Rogers and W. E. Cadwallader, who are both members of the Association. This fire, which he remarked was in request, was described on p. 127 of the "JOURNAL" for July 20.

Another direction in which improvement would be welcomed, added the President, was in connection with the ovens of gas-cookers, so as to prevent the products of combustion coming in contact with articles cooking, and also to obviate the splashing of grease on to the oven-walls. He suggested that young members of the Association engaged in cooker work might well look into these matters, and not accept the present type of cooker as finality. These and many other problems were awaiting solution; and they must be ever ready to seize and act upon any inspiration for effecting progress, and thereby assisting in securing the well-being of the human race.

Mr. R. G. MARSH (Birmingham) proposed a hearty vote of thanks to the President for his address, and for consenting to remain in office for a second year.

Mr. J. POULSON (Stafford), in seconding, remarked that they generally found the President struck out a line for himself; and on the present occasion his reference to the increased oxidation of service-pipes under certain conditions showed how acute he was in looking after small matters.

After the vote of thanks had been cordially passed, and acknowledged,

The PRESIDENT called upon Mr. E. Stroud, Chief Engineer to the Holophane Company, to deliver a lecture on

MODERN ILLUMINATION AS APPLIED TO GAS LIGHTING.

Mr. STROUD began by remarking that while, with the present lighting restrictions, it might seem rather inopportune to introduce a discussion on good lighting and efficient methods of illumination, it was a fact that lighting had been perhaps one of the most discussed of the minor subjects during the past few months. In some respects, the changes which were taking place as to the shading of extraneous light, and the re-directing of the rays where they were necessary, had been advocated by illuminating engineers for many years. Some shop windows in the past had had brilliant unshaded light-sources placed more or less directly in the line of vision—thus obstructing a view of the goods they were meant to illuminate. In the case of street lighting, similar conditions existed. Spot lighting was generally to be found, which, while illuminating parts of a street with excessive brilliancy, left other portions in comparative darkness.

Until lately, the method adopted for the reduction of lighting in London was the obscuring of the upper part of the existing lanterns, leaving the lower portion transparent. But this, though it achieved the object of obscuring from view the surrounding buildings, allowed an extremely bright patch of light to be thrown directly on the ground surrounding the standards. This excessive contrast from the apparent bright spots to absolute darkness, left much to be wished; and in the new lighting order, dated Sept. 28, a desire was expressed for more even illumination in streets. To this end, the lower portions of the lamps were now matted, so as to afford a more diffused distribution; and at the same time the upper portions of the lanterns had in some cases been treated with semi-transparent distemper, to avoid excessive contrasts.

These methods being extremely inefficient, lighting engineers were devoting their attention to devising suitable refracting and diffusing globes which would throw the light along the streets without allowing it to pass in an upward direction. With shop-windows, the object had been achieved in various ways—for instance, by placing coloured material around the lights, or actually painting the lamps and reflectors, so as to allow just a small amount of the light to be directed on to the goods. The most successful method so far adopted, however—at one and the same time meeting the regulations and giving the most efficient lighting to the goods—was the use of concealed lighting. This was undoubtedly the most reasonable plan to adopt for any window. The light reflected into the street depended, of course, on the character of the goods—the lighter the goods, the greater being the reflection.

The reduction in lighting necessary should naturally be determined by the heights of the adjacent buildings, and the width of the thoroughfares, as it was obvious that, with very high buildings and narrow streets, there would be a very limited angle at which it would be possible for hostile air-craft to locate the light. Both for the sake of shopkeepers and the safety of the pedestrians, it was desirable to get the maximum illumination permissible; and to the lighting engineer the solution seemed to be that a certain maximum foot-candle illumination on the streets should be stipulated by the authorities, taking into account the local conditions

The lighting engineer would be only too pleased to co-operate with the authorities to this end.

The lecturer went on to remark that there was one aspect of illuminating engineering which did not come under the ban of restriction, and that was the lighting of factories. With thousands of factories working day and night in the production of munitions, &c., it was of paramount importance that the lighting should be arranged in a proper manner. There were also many new factories in course of erection; and it would seem a wasted opportunity if the lighting was not laid out on the most up-to-date and scientific lines. The present was, in fact, an unprecedented time for the skill of the lighting engineer. So important, indeed, was this matter of factory lighting, said Mr. Stroud, that the Government some time ago appointed a Committee to go into it; and he drew attention to their recently issued report [which, with the evidence given before the Committee, has already received full notice in the pages of the "JOURNAL"]. This document, he said, was extremely interesting, and showed that the authorities were now taking into account lighting conditions, just as they did heating and ventilation. With large factories there was an enormous scope for high-pressure gas systems, on account of their extreme efficiency, and the few points it was necessary to instal in order to get the desired effect.

Proceeding to explain concisely the methods of obtaining from the bare crude sources the finished product (in effect, the illumination on the working plane), Mr. Stroud described the photometric or polar curve—the graphic representation of the light distribution. By means of a photometer, the intensity of light from a given source could be determined for various angles, these usually being in a vertical plane through the lamp axis; and the intensities obtained, expressed in terms of the candle-power, could be plotted in such a way as to convey a clear idea of the manner in which the light was emitted. He threw on a screen slides showing the distribution of light obtained from an upright and an inverted gas-burner, as well as from electric lamps. He pointed out that, in the case of the upright gas mantle and ordinary tungsten lamp, the maximum candle-power was given out in the horizontal direction, with great diminution in the vertical; while with the inverted gas-burner and gas-filled electric lamps, the candle-power was approximately the same over the lower hemisphere. It would, on consideration, be seen that it was impossible to design any source that would give the greater portion of its light in the direction in which it was needed—namely, within a zone of 60° above the vertical. Some system of reflection must therefore be employed to obtain the desired results in practice; and by means of prismatic glassware, it was possible to throw the light in any predetermined direction. Then, again, owing to the extreme brightness of modern sources, it was generally necessary to diffuse over a larger area, so as to reduce the intrinsic brilliancy. This could be effected by prismatic glassware, or opal, satin finished, or sand-blasted globes.

The next portion of the lecture dealt with illumination calculations, the whole basis of which, Mr. Stroud pointed out, was that light varies inversely as the square of the distance. The unit used for the measurement of illumination—the foot-candle—was explained; and the illumination formulæ given in the paper presented by Mr. V. H. Mackinney and himself to the Midland Association of Gas Engineers and Managers in the early part of this year [see "JOURNAL" for March 16, p. 661] were quoted. The foot-candle, he said, was the illumination obtained on a surface 1 foot away from the light-source which was of 1 candle-power when it was at right angles to the light-ray. The same light-source of 1 candle-power at a distance of 2 feet would have to cover an area four times greater than at 1 foot; and as it was covered by the same quantity of illumination, the intensity must be one-quarter. It was, however, added by the lecturer that the calculations to which he had referred need not trouble the ordinary individual, as all reputable illuminating firms issued curves and data drawn in a practical form; and it was only necessary to abide by their spacing rules, &c., to get the desired results. He exhibited and showed the working of a "Holophane Lumeter," which enables one to measure the illumination of practical installations to a great degree of accuracy. This the members saw is an extremely portable piece of apparatus, which can be carried and used with the ease of a small camera.

There was also thrown on the screen during the lecture the table, given with the Midland Association paper already alluded to, of average foot-candle intensities recommended for various purposes; and attention was drawn to a table, published on the same occasion, showing that, while direct illumination calculations did not take into account the effect of surroundings, it was possible to obtain as much as 80 per cent. increase if the surroundings were very light. In ordinary practice, however, it was usually safe to allow for an increase of 25 per cent. Emphasis was laid on the importance, in designing lighting installations, of ensuring that shadows are not cast which would prove objectionable.

Slides were shown giving some installation data as set out and published by the Holophane Company, as well as a number of excellent examples of gas street and shop lighting; and after the lecture members were able to examine a selection of specimens of Holophane glassware.

The PRESIDENT proposed a hearty vote of thanks to Mr. Stroud for the lecture, and to his assistant, Mr. Tye. It was almost impossible to at once absorb matter like this, so as to readily ask questions upon it; but there was one commercial point which had struck him. They were all aware that glass had risen very much in price; and he would like to know whether this was the case with the Holophane Company's goods. He was in possession of the firm's catalogues; and though undoubtedly the glassware was worth the money, it was sometimes difficult to persuade consumers of the fact. Another thing about Holophane glass was that it seemed to retain a certain amount of dust.

Mr. F. A. JENKINS (Leamington) seconded the proposition, which was passed with acclamation.

Mr. STROUD, in acknowledgment, said the subject of illumination was a very absorbing one; and the more it was gone into, the more important it became. It seemed a shame that lighting should be installed in the haphazard way one saw. They did not find heating and ventilation carried out in the same loose manner. These requirements were properly specified; and the lighting should be treated similarly. His firm had glassware for which they claimed certain advantages; but at the same time they were engaged in "spreading the gospel" of illumination. The prisms would collect more dust than a clean surface; but it must be remembered that dust did not affect them so much as some other types of globes, while in any case they contended that it did not affect them more than other glass. It had been necessary to put their glass up 10 per cent.; but he would like to point out that nine-tenths of their ware was made in England, and the remaining one-tenth in America.

This concluded the formal business of the meeting.

VISIT TO THE PERTH GAS-WORKS.

Members of the Scottish Junior Gas Association (Eastern District) on Saturday afternoon paid a visit to the Perth Gas-Works, over the inspection of which a couple of hours were profitably occupied.

A feature of interest was a verbal description by Mr. A. R. Wilson of the tar plant—particularly the new dehydration apparatus, which has just been completed. Mr. David Vass, the Corporation Gas Engineer, also gave the visitors some information on the same subject. The members were afterwards entertained at tea in the Windsor Restaurant.

The tar distillation plant consists of two independent systems—an intermittent plant for the working-up of tar to the pitch stage, and a dehydrating plant, worked on the continuous principle. The latter has just been put into operation; while the former was installed twelve years ago.

The intermittent plant consists of two stills, each of 1000 gallons capacity; and each still is complete with condenser, receiving box, and pitch bed. Heat is obtained by means of a coke producer—a system which allows of easy regulation. Refined tar or pitch can be made by this plant at will, although the bulk of the trade is done in refined tar.

The continuous process plant, which has been erected by Messrs. Hird, Chambers, and Hammond, is capable of dehydrating six tons of tar per twenty-four hours. It consists of a rectangular shaped still with vapour pipe connected to the condenser, also a heat exchanger for recovering some of the heat from dehydrated tar.

The crude tar is pumped to an overhead storage tank; flowing thence by gravity to the condenser, where it receives a preliminary heating by cooling the hot vapours from the still. It then enters the heat exchanger, which consists of a tube within a tube; the crude tar entering the inner tube and being further raised in temperature by the heat of the dehydrated tar which is passing through the outer tube. Entering the still, the tar is made to traverse this twice by means of a baffle-plate, when the dehydration is completed. Leaving the still, the dehydrated tar passes on to the outer tube of the heat exchanger, after which it is run to the storage tank.

The still is heated by a Goodrich and Hamlyn pressure furnace, fired by breeze; the hot gases being conducted (locomotive boiler fashion) through the body of the tar, in three 5-inch diameter tubes. The depth of tar in the still never exceeds 14 inches; so that plenty of free space is left for frothing, and a boil-over cannot occur. Once the plant is started, it requires very little attention; but, of course, the heat must be kept uniform.

In designing the plant provision has been made for the addition at some future date of units for the complete distillation of tar up to pitch.

The pension granted by the Metropolitan Water Board to Mr. William Morris, the late Engineer of the Kent District (whose death, in his eightieth year, was recently recorded in the pages of the "JOURNAL"), was £1215 8s. per annum. He left estate of the gross value of £28,267.

At last Friday's meeting of the Metropolitan Water Board the Finance Committee reported that an award had been made in the arbitration proceedings between the Board and the Corporation of Hertford, with reference to the Hertford sewage-works, and included the estimates (amounting to £33,373) in their report. They have arranged with the Hertford Corporation for payment of £25,000 of the award to be deferred until six months after the declaration of peace. In the meantime, interest at 4¾ per cent. per annum will be paid on the amount. The Corporation originally claimed £48,141; while the Board offered £20,673.

THE SOUTHERN GAS ASSOCIATION PAPERS.

READ AT THE MEETING, THURSDAY, NOV. 11.

SOME NOTES ON THE PARTIAL DISTILLATION OF TAR IN A WILTON'S CONTINUOUS STILL.

By Frank Livesey, B.A., Assoc.M.Inst.C.E.

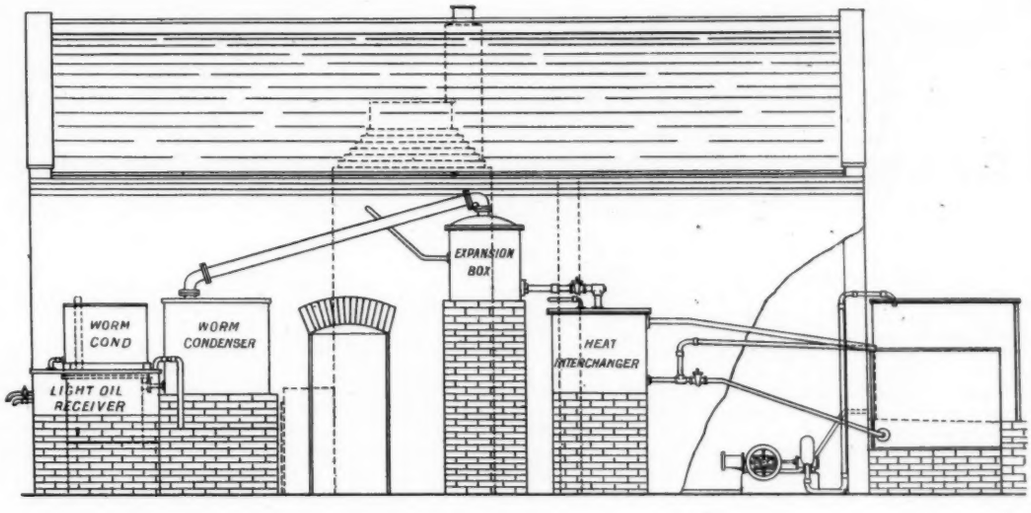
At the present moment a large number of medium-sized gas-works have just installed, or have on order, some form of tar-dehydration plant. I thought, therefore, that a short paper on my experience at Maidstone with a Wilton plant might prove of interest to some, and in all probability promote a profitable discussion.

At Maidstone for many years a not satisfactory feature of the carbonizing methods has been the large water content of the coal tar produced. I am speaking of the time before stoking machinery and heavy charges had been adopted; and at this period it was found desirable to work off in 4¾ hours charges of 336 lbs. of coal per stop-end retort of 10 feet in length. One of the results of these light charges at high temperatures was a high free carbon content of the tar—never below 18 per cent., and on occasions rising to no less than 30 per cent. Although the tar after leaving the tar-towers was passed through two separators, the free carbon hung tenaciously to the liquor, with the result that the coal tar not infrequently contained 15 per cent. of liquor.

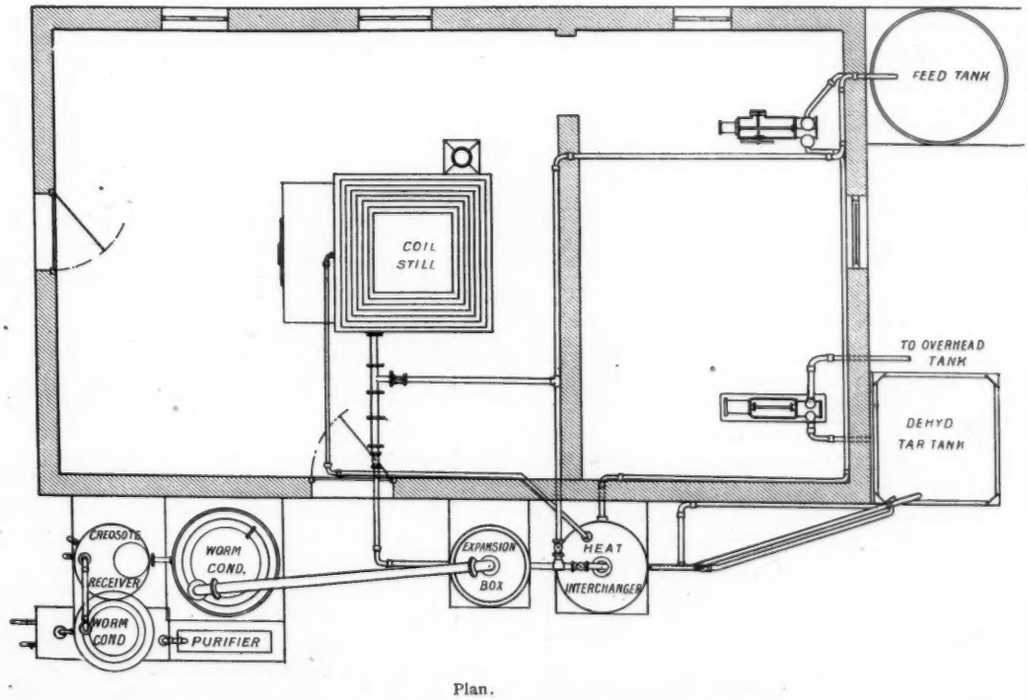
Our coal tar when rubbed with a knife on a piece of glass gave up the liquor with readiness; and this led us to experiment with passing the tar through a machine consisting of two pairs of machined rollers fitted with scrapers to remove the tar. This machine showed some promising signs; but the difficulty in forcing the tar between the rollers at a sufficient speed caused the abandonment of experiments in this direction. As we have only one tar and liquor well, it is our custom to mix all our coal tar and carburetted water gas tar which contains 25 to 40 per cent. of water.

Description of Plant.

In the spring of 1911, after having found that all efforts to completely dehydrate our mixed tar with steam coils were useless, we put down a Wilton plant of a capacity of 4000 gallons of crude tar per twenty-four hours. The plant consists of a feed tank of



Longitudinal Section.



Plan.

THE WILTON DEHYDRATING PLANT AT THE MAIDSTONE GAS-WORKS.

550 gallons capacity, heat interchanger, cast-iron coil-still consisting of twelve circular coils 3 feet diameter and 2-inch bore expansion box, from which the tar flows to the heat exchanger, and thence to the finished tar-tank. From the expansion box the vapours pass through a cast-iron worm condenser and thence to the light oil receiver.

The various vessels are arranged as shown on the illustration. The still is placed in a brick and tiled building to protect it from the weather, and also to shelter the man engaged in operating the plant. At night time this is important; for since the operator can get his meals in comfort, he has no temptation to leave the plant. At the far end of the building a space is shut off by a wall for the two pumps.

One of the pumps is used to force the tar from the feed tank through the plant; and the operator, when firing-up or sitting down to his meals, can see the fly-wheel of the feed pump. It is thus never allowed to stop, as stoppages in time lead to the pitching of the coil. The other pump is for pumping the treated tar from the receiving tank to an overhead boiler for loading purposes. This boiler is of 5000 gallons capacity, and is fitted with a steam coil for cold weather.

The division wall was provided to protect the pump in case of fire, and enable the operator to safely get to the pumps and shut off the tar supply. We have experienced a small fire on the plant, and these provisions justified themselves.

The furnace is fitted with Wilton's forced draught; and from the back of the furnace a central uptake leads the gases to the top of the coil, whence they pass down the annular space and up the flue.

After a short experience of the plant we found that, when working at a temperature of 130° C. in the tar, we were unable to extract our water content. This content was high, and some 4 or 5 per cent. of water remained. The steam-blast was increased to the maximum which the flues could deal with. We found that the crude tar was not leaving the heat interchanger at more than 60° C.; and so between the heat interchanger and the still we added a steam-heater, consisting of an old oil carburettor. This brought up the temperature of the tar to 100° C. before entering the coil, and enabled us to keep up a temperature of 150° C. at the outlet of the coil with an output of 3000 gallons per twenty-four hours.

When the plant was first installed, we laid a 2-inch pipe from the top of the oil-receiving box to our foul-gas main at the inlet of the exhauster—a distance of about 40 feet; but this arrangement was found to be unsatisfactory, owing to the deposition of ammonium salts in the pipe. It was also found that working at 150° C. the condenser provided was insufficient to cool the vapours sufficiently on entering the vapour catch-box.

A small washer, consisting of a cast-iron tank with a perforated dip-pipe running its complete length and sealed about 2 inches in the liquor, was provided; and a vent was furnished from this washer to a small oxide purifier. This arrangement worked satisfactorily for some time, and prevented loss of ammonia; and when working up to 150° C., we were able to run off cool liquor to the well.

In the district round Maidstone, large quantities of Kentish ragstone are quarried. This is a limestone containing from 70 to 90 per cent. of carbonate of lime, and when treated with tar is a most valuable material for road and path work. A good demand exists in the neighbourhood for a refined tar suitable for the purpose. The tar should be free from ammoniacal liquor, the free carbon should not exceed 16 per cent., the middle and heavy oils should be left in the tar, but the naphthalene content should not be too high.

Tar produced during carbonization at low heats is usually preferred; but this is chiefly because the free carbon content is satisfactory. In our case, heavier charges of longer duration have reduced this to the required figure; but, in pursuit of the other features, I determined to work at higher temperatures, and for some time past the plant has been worked at 170° C. in the tar. This necessitated alterations to the condensing plant; and a second condenser was therefore installed between the washer and the vapour catch-box.

A stream of water is run into the bottom of the second condenser and out of the top, whence it flows into the bottom of the first condenser and thence to waste. By a careful regulation of the flow of water, which is extremely small, the light creosote oils can be collected from the first vapour box, and the liquor and the crude naphtha can be removed from two cocks at different levels in the washer. We usually divide the oils into those heavier and those lighter than water. The creosote oils when the first vapour box is kept at a temperature of 93° C. tests as follows: Specific gravity, 1·028; water, 3 per cent.; phenols, 9 per cent.; naphthalene, 26·3 per cent.; and is liquid at 30° C.

We have an air-tight settling tank into which the creosote oils are run in normal times, and a considerable amount of the naphthalene salts allowed to crystallize. By this means we can provide a suitable creosote for remixing with the tar for our exhausters or for the market for the preservation of timber. Unfortunately, it is very difficult to find a market in normal times for the naphthalene salts. The naphtha, after two washings and three distillations, yields 45·5 per cent. of benzol, giving 90 per cent. at 120°.

In time of peace, should the price of motor spirit remain at the very high figure it has now reached, I shall rectify sufficient benzol for use on our own motors; but I do not believe that it is wise for any undertaking of less than 1000 millions output per annum to undertake complete tar-distillation. The quantities of the various products are too small to warrant the expenditure; our potential production of benzol being only from 5000 to 7000 gallons per year.

The difficulty of disposing of the solvent naphtha, tar acids, and naphthalene except through a tar distiller, who prefers to do the work himself, is a great obstacle. Gas undertakings will, however, find that in most localities there is a market for creosote and benzol, and most of the remaining products can be returned to the dehydrated tar. If, however, benzol is to become largely used for motors, great care must be taken as to the standardization of the quality sold. Too little attention has been given to this in the past. By doing the final condensation in a rectangular cast-iron tank, the difficulty experienced in working the vapour through a cold cast-iron worm coil condenser, which would be frequently blocking with naphthalene, is avoided.

The outlet bend of the second condenser is never allowed to be stone cold, and no trouble is now experienced. A steam connection is, however, provided, to clear the coil in case of necessity. The result of this condenser blocking is merely to cause a sufficient pressure to blow the seal between the expansion box and the heat interchanger, and to allow vapour and steam to blow out into the finished tar-tank. Directly the stoppage is removed, the tar refils the seal in a minute or two.

The small oxide purifier, though only 4 ft. by 2 ft. by 2 ft., runs for many months without requiring any attention—in fact, if the purifier gets foul it is usually a sign that the condensers are not working properly. The liquor comes off at a strength of 11 oz., and is run through a cooling pipe surrounded by cold water, and thence to the well; while the oils are loaded into steel drums for despatch to our distillers.

Tar Treatment for Toluol Extraction.

After the outbreak of the war, we were impressed with the importance of treating our tar at still higher temperatures, to remove the entire toluol fraction; and as no two tars are probably exactly similar, I give the results of our tests at various temperatures:

Temperature of Still. Deg. C.	Toluol Content. Per Cent.
190	·2
200	·153
210	·025
220	·007 to *nil*
230	*Nil*

To reach a temperature of 200° C. and at the same time to obtain a fair output from the plant, as we had exhausted the preheating capacity of steam we first experimented with a cast-iron preheater placed in the uptake of the furnace, which was fitted with inlet and outlet cocks and bye-pass, and also with arrangements for cleaning out if necessary. This worked satisfactorily for some time, but was superseded by a U pipe leading from the top of the coil and placed in the uptake. This, again, however, though giving us the increase in heat we required, was not quite satisfactory, owing to the great expansion caused by the intense heat of the uptake. We have now dispensed with this, and added four more complete coils at the top of the still—making sixteen coils in all.

There are certain disadvantages when working at 230° C. The tar, when cool, becomes extremely thick; and as our creosote is now wanted by the tar distiller for toluene removal, we cannot thin it out. In fact, unless the tar is removed and used with reasonable speed, in cold weather it will be impossible to get it from the barrels or underground tanks. If the difficulty becomes more acute, it will probably be necessary for us to redistil the creosote out into two fractions, and return the heavier fraction to the tar.

In shutting-down, certain precautions appear to be very necessary. The fire is drawn and the dehydration process continued until the temperature has fallen to 130° C. The object of this is to fill the preheater with tar that can be drained out after cooling. The tar is then prevented from entering the expansion box, and is circulated back to the feed tank until the temperature is reduced to a point at which it is safe to introduce water into the coil to force out the remaining tar. A steam connection is also provided, so that steam can be turned into the coil if required. The heat interchanger is then drained by a cock at the bottom into the finished tar tank; and by this precaution no trouble will be experienced on starting up the plant again.

With regard to repairs, we have been very fortunate; and in this respect the plant is all that can be desired. The amount of crude tar which has been passed through the plant is approximately 1,200,000 gallons; and the repairs, with the exception of those necessary after our small fire (which were covered by insurance), have been practically *nil*. One pump has had an overhaul, and the furnace has been twice patched. Nothing has been done to the coil or any of the joints; but we have broken the top joint occasionally for inspection, and found the interior to be quite clean, with no signs of pitch.

The cast-iron coil still seems to me to have advantages over other types built of mild steel or wrought iron, which must necessarily have a short life. The danger of fire in the Wilton plant appears to be reduced to a minimum. The coil contains only a small quantity of tar; and any leakage which might take place would find its way into the flue, not into the furnace.

I give below the results of some tests made to show the capacity of the plant at different temperatures:

—	230°.	220°.	210°.	200°.	190°.
Crude tar used per hour . .	222·8	198·8	192·8	225·6	179·7
Dehydrated tar per hour . .	107·0	138·0	120·5	156·9	132·8
Dehydrated tar, per cent. .	48·0	69·4	62·6	69·5	73·0
Capacity of plant per 24 hours	2568·0	3312·0	2892·0	3765·6	3187·2
Crude tar used per 24 hours .	5347·2	4771·2	4627·2	5414·4	4272·8

These tests are in some respects rather anomalous, as, not being taken on the same day, the qualities of the crude tar treated, and also probably of the fuel, were not identical.

One disadvantage of working at a high temperature is the difficulty of obtaining a sufficient supply of dehydrated tar to meet the requirements of one's customers during the hot weather in the summer, when nearly all our tar is sold for road purposes; and though we have loyally maintained our temperature, it has been rather trying to feel that on some occasions this has forced our customers to go elsewhere to obtain their supplies. On the other hand, the value of the heavier fraction extracted is greater than the value of dehydrated tar; and so it is obvious that it pays to work at high temperatures. At a working temperature of 220° C. the financial results are as follows:—

By 556 gallons of refined tar at 2¾d. per gallon . . .	£6	7 5
206 gallons of creosote } at 5¾d. per gallon . . .	6	8 7
62½ gallons of naphtha }		
67½ gallons of 5° Twaddel liquor	4	1
	£13	0 1
Less working costs:		
884 gallons of crude tar at 2¼d. per gallon	£8	5 9
Labour, 6½ hours	3	0
Coke, 3 cwt. at 1s. 6d. per cwt.	4	6
Interest and depreciation at 7 per cent. on £400, adjusted to gallonage	1	7
	£8	14 10
£13 0 1		
8 14 10		
Net profit £4	5	3

Or nearly 1·15d. profit per gallon of crude tar treated.

At a working temperature of 200° C. the financial results were as follows:

By 580 gallons of refined tar at 2¾d. per gallon. . . .	£6	12 11
185 gallons of creosote } at 5¾d. per gallon. . . .	5	18 10
63 gallons of naphtha }		
78 gallons of liquor.	4	9
	£12	16 6
Less working costs:		
907 gallons of crude tar at 2¼d. per gallon	£8	10 1
Labour, 6 hours	2	9
Coke 2½ cwt. at 1s. 6d.	3	9
Interest and depreciation at 7 per cent. on £400, adjusted to gallonage	1	8
	£8	18 3
£12 16 6		
8 18 3		
Net profit. £3	18	3

Or 1·03d. profit per gallon of crude tar treated.

The increase of profit in the year by working at higher temperatures amounts to £130.

These are reasonable profits; but, of course, we have been using the "C" process. This, in our case, though not costing as much for installation as it has done to many companies, yet has not been done for nothing, as the cooling question during the summer months was not easily solved.

The working pressure on the plant varies considerably with the quality of the tar treated and the condition of the pump. Our pump is a small horizontal Evans; and we find it a good plan to allow a fair amount slip past the valve, so that the pressure is moderate. With tar of 7 to 15 per cent. water content, our pressure is from 15 to 25 lbs. per square inch; but with tar containing 30 per cent. of water it is rather higher. Our pressure gauge is fixed to a 4-feet syphon and sealed with cylinder oil. With this arrangement, no trouble is experienced. The heat efficiency of the plant is from 38 to 40 per cent. The cost of the plant was £265, and the bullding £130.

The demand for the rectified products of coal tar is now very great; and in the case of some products—toluol and carbolic especially—increases have taken place since July, 1914. These increases, however, do not represent nearly so great a percentage as the advance in coal prices or in freights; and our gains as an industry in no way begin to balance our losses. I do not agree with those who say that after the war the demand for the rectified products will be good, and the prices high. My own experience goes to show that in normal times the distillate produced in my plant is sometimes unsaleable, and seldom fetches a price greater than that of dehydrated tar.

Gas undertakings are now being pressed to adopt the "C" process and tar dehydration. To some of them neither process will be profitable. While it is undoubtedly the duty of every undertaking not to spare itself to assist the Government in every way, it is only right that the Government Departments should make it their business to see that no excessive profits are made. At the same time, the carrying out of this patriotic work should in every case be a source of a fair and reasonable profit to the gas undertaking.

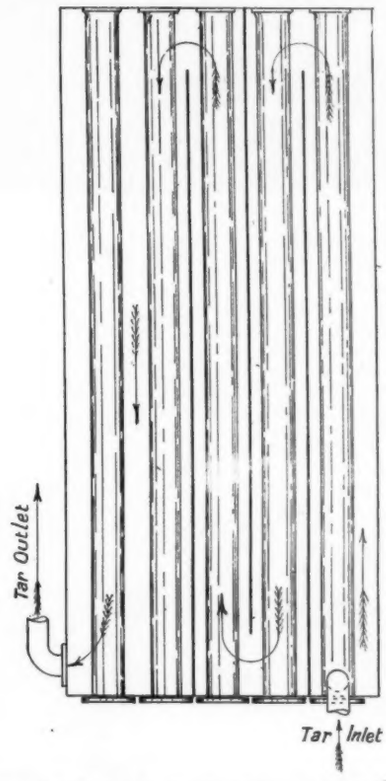
NOTES ON TAR DEHYDRATION.

By R. Wardell, of Tottenham.

Within recent years the treatment of road-surfaces with dehydrated tar has received a considerable amount of attention, and various types of plant have been designed and manufactured in order to prepare tar for this purpose, one of which is that known as the "Hird" continuous process, as installed at Tottenham. It is to this particular type that I shall confine my few remarks.

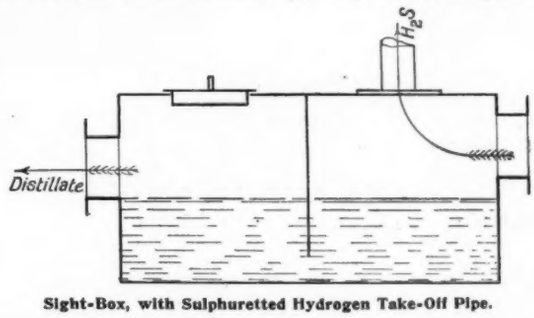
Description of the Plant.

The plant proper consists of five vessels—the still A, heat interchanger B, condenser C, and two sight seal-boxes D; and it is capable of dealing with 20 tons of tar per day. In addition to



Section of Still, showing Heating Tubes and Baffle-Plates.

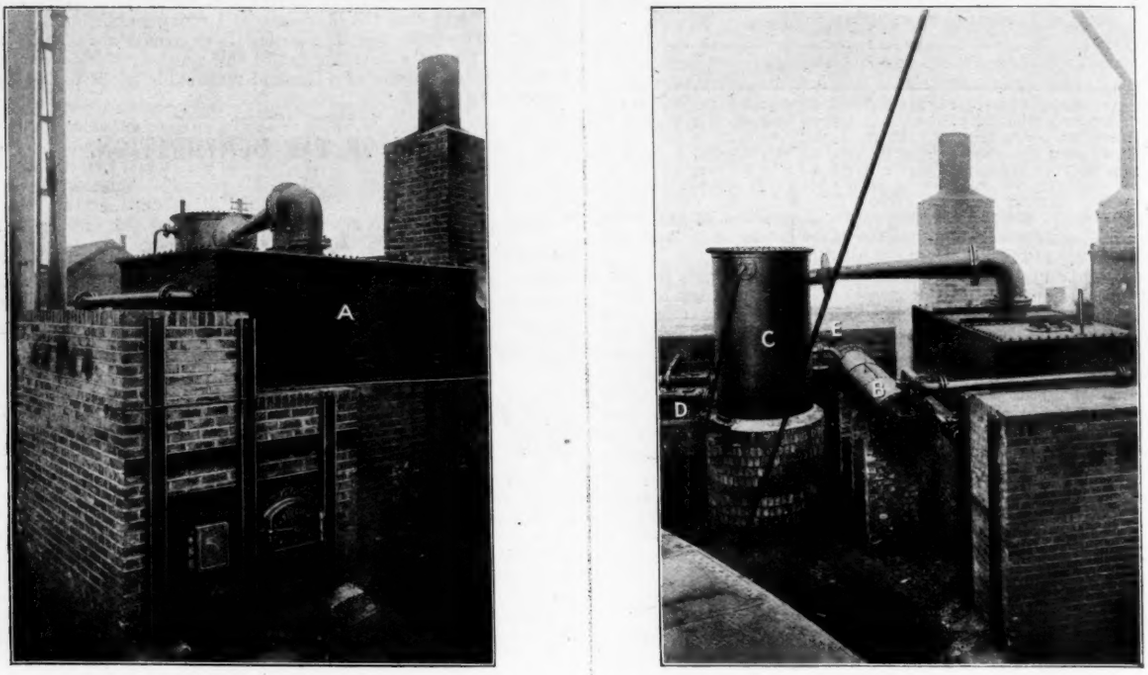
this, there are storage tanks for receiving the distillate and dehydrated tar respectively, together with feed-pump, or overhead tank as the case may be—depending whether the tar is forced into the still, or is allowed to flow by gravity through the plant.



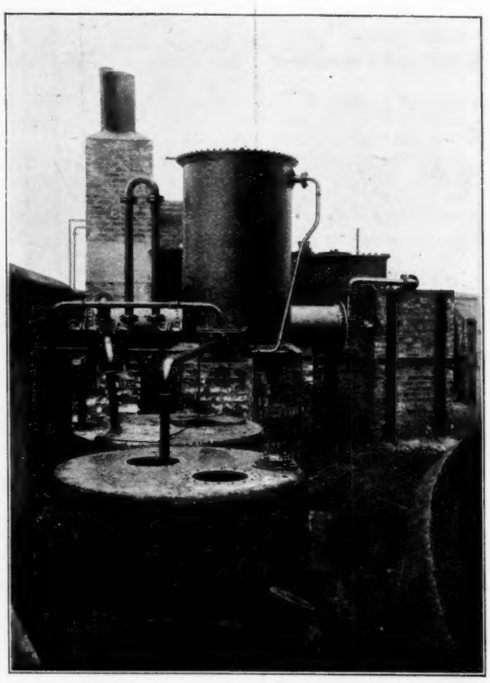
Sight-Box, with Sulphuretted Hydrogen Take-Off Pipe.

The still is built of mild-steel plates, is rectangular in shape, 11 ft. long by 5 ft. wide by 3 ft. 6 in. deep. It is fitted with one horizontal row of five 6-inch steel tubes, running longitudinally and placed about 3 inches from the bottom of the still.

Vertical baffle-plates, 21 inches deep, are fixed between the tubes in such a manner that the tar is made to travel from end to end of the still four times on its way from the inlet to the outlet pipe—a total distance of (approximately) 40 feet.



SOME VIEWS OF THE TOTTENHAM TAR DEHYDRATION PLANT.



The sectional plan shows the tubes and baffle-plates, and arrows denote the travel of the tar.

Two manholes on the top and three handholes on one side are provided for inspection and cleaning-out purposes.

The heat interchanger is composed of two steel tubes placed horizontally, one inside the other. The outer tube is 11 ft. long by 2 ft. diameter, and the inner 11 ft. long by 1 ft. diameter; and they are secured together by two end plates. The crude tar passes through the inner tube in one direction, and the dehydrated tar along the annular space in the opposite direction. A run-off cock at the bottom is used to empty the still when required.

The condenser is 4 ft. diameter by 7 ft. deep, and is fitted with a 3-inch cast-iron coil, through which the vapours from the still pass.

The sight seal-boxes are provided with a mid-feather; and on the top there is a take-off pipe for any sulphuretted hydrogen present; and also a lid through which samples of distillate or prepared tar respectively can be readily taken.

A furnace suitable for burning coke-breeze is placed under the still at one end, and is supplied with forced draught. The furnace gases pass through the heating tubes away to the chimney.

The foregoing is a brief description of the plant. Now, with reference to its working.

Working of the Plant.

The crude tar is, in our case, pumped direct from the wells, slowly and continuously, into the condenser, where it serves as the cooling agent for condensing the vapours from the still, and is itself, at the same time appreciably raised in temperature.

The tar leaves the condenser through an inverted U pipe, and passes into the heat interchanger. Here a considerable amount of heat is imparted to it by the outgoing tar, and it enters the still at about 160° Fahr. It then slowly travels along the four channels formed by the baffle-plates, giving off the light and middle oils on its way to the outlet pipe. Thence it flows into the annular space of the heat interchanger, and then through the overflow-pipe E into the sight-box, and away to the storage tank. The vapours pass along the still head into the condenser, and the condensate flows, by gravity, through the second sight-box into the receiving-tank. The ammoniacal liquor is run off from the bottom of the vessel into the wells. Any sulphuretted hydrogen gas is trapped at the seal-box, and travels along the take-off pipe (shown) to a small oxide purifier.

We have experienced no difficulty in dehydrating either coal gas or carburetted water gas tar; and the flexibility of the plant is probably due to the design of the still, which provides for the heating of a shallow body of tar with an ample vapour space above.

The depth of tar is 15 inches and the vapour space 2 ft. 3 in. This arrangement appears to overcome any tendency to priming, even when working on tar containing a high percentage of water.

Distillation of Carburetted Water-Gas Tar.

During a 15-hour test, 1410 gallons of carburetted water-gas tar were passed through the still and maintained at an average temperature of 296° Fahr. by the consumption of 14 cwt. 1 qr. 21 lbs. of coke-breeze.

Tests of the tar are given below, together with the cost per 24 hours run.

	Crude Tar.	Dehydrated Tar.	Distillate.
Water	31 per cent.	Less than 1 per cent	91 per cent.
Light oils (up to 170° C.)	15 per cent.	7½ per cent.	2½ per cent.
Specific gravity	1·054	1·097	·905

	15 Hours.	24 Hours.	Cost per 24 Hours.
Tar (gallons)	1410	2256	
Fuel (cwt.)	14·3	23	11s. 6d.
Steam, oil, &c.			2 6
Wages			8 3
Interest and depreciation			3 10
			£1 6 1

This cost is equivalent to 0·14d. per gallon, or 2s. 5½d. per ton of tar treated.

It will be seen that with tar containing a high percentage of water, more than 2200 gallons of it can be effectually treated per

24 hours in this size of plant. The higher the water content of the tar, the slower must be the travel of the tar through the still in order to obtain thorough dehydration.

Tests of Coal-Gas Tar.

With a still temperature of 400° Fahr., all the light oils, and most of the phenols, are driven off. But it is necessary to work at 500° Fahr. in order to liberate the whole of the crystallizable phenols, and so comply with the requirements of the No. 2 Specification of the Roads Board authorities.

At 400° Fahr. the distillate tests gave the following results:

Specific gravity ·950.
100 c.c. fractionated 5 per cent. at 100° C.
17 per cent. at 120° C.
Tar acids, phenols 11 per cent.
Prepared tar was entirely free of water.

At 500° Fahr. the distillation test of the prepared tar was as follows:

Up to 140° C., no water.
do. 140° to 220° C., 2·6 per cent. distillate.
140° to 300° C., 22 per cent. do.
Prepared tar: Specific gravity, 1·21.
Distillate: Specific gravity, ·995.
100 c.c. fractionated 23 per cent. at 200° C. benzol, toluol, and solvent naphtha.
Tar acids and phenols, 18 per cent.
Pyridine bases and pyridine, 3 per cent.

Fuel tests were not taken; but in view of the fact that carburetted water-gas tar containing 31 per cent. of water can be dehydrated for 0·14d. per gallon, crude coal-gas tar containing (say) 5 to 10 per cent. of water ought to be prepared at a cost of not more than $\frac{1}{10}$d. to $\frac{1}{8}$d. per gallon.

When working at 500° Fahr., we were troubled at first with the deposition of naphthalene in the distillate pipe beyond the sight-box. But this difficulty was overcome by inserting a steam-pipe in the distillate pipe, and keeping the condensate hot, in order that all the naphthalene should be carried forward into the receiving-tank.

The condenser is connected in the opposite way to that usually followed in gas-works practice; the object being to keep the distillate warm and prevent naphthalene stoppages.

An appreciable saving in fuel was effected by raising the brickwork to the top of the still along both sides, and packing the cavity between the brickwork and the still with slag wool.

With the present heavy demand for toluol and benzol—a demand that is likely to continue after the close of the war—a plant of this type, which can prepare the crude fractions, will, I think, prove a useful addition to many of the large and medium-size gas-works, the installation of which will lead in not a few cases to the erection of a complete tar-distillation plant.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to the Greenock Gas-Works.

On Saturday, the members of the Scottish Junior Gas Association to about the number of sixty visited the Greenock Corporation Gas-Works at Inchgreen. Under ideal weather conditions the party spent a most interesting and enjoyable afternoon going over the installation of Woodall-Duckham vertical retorts, the liquid ammonia plant, and in viewing the new million cubic feet capacity gasholder in course of erection. Great interest was shown in the mechanical handling of the coal, from the tipping of the truck to the means adopted of tripping the conveyor buckets and so discharging the coal at any desired place. The power throughout is obtained from electric motors; the electricity being generated in the works. A very fine chemical laboratory and coal-testing plant add to the completeness of the works.

From the works the party went to the new show-rooms, where a goodly selection of gas fires, cookers, hot-water circulators, boilers, and furnaces are exhibited to the best advantage in a roomy and well-lit show-room. A set of model apartments (kitchen, dining-room, bedroom, and bathroom) are fitted up to show what can be done by gas. The whole display leaves little to be desired or criticized.

The party were afterwards entertained to tea in a hall which is set apart for demonstration purposes, and in which free cookery demonstrations are given periodically.

In welcoming the party, the Convener of the Gas Committee said that if anyone present had seen the gas-works six years ago, he would realize what a tremendous amount of work Mr. MacLeod had accomplished since he came to Greenock. Practically everything on the works was new; and while some things might be open to criticism, he thought they had done fairly well. They had to build the new plant practically on the site of the old works; and they therefore had not the same freedom of action in designing the works as they would have had if the old ones had not been there. In putting up their new plant, they had erected what they considered ample to cope with any increased consumption that might be anticipated. The plant itself had more than justified their expectation. But the increase in gas consumption had exceeded their anticipation; and he thought the time was not far distant when additional plant would require to be installed. This, of course, had been provided for, as space for new retorts had been left alongside the present ones. He would be pleased to hear any criticism members of the party would like to offer, as they at Greenock were not above taking a hint. He hoped that at some future date he would again have the pleasure of welcoming the Association to Greenock.

The President (Mr. David Fulton), in reply, said the Association were greatly indebted to the Greenock Corporation for their kindness in allowing the members to visit the works; the educational value of such visits being invaluable to all of them.

Mr. MacLeod said that, in setting about the new work, he had followed the Scottish trait of extreme caution; and he advised the members, if they ever had similar work to undertake, to err on the side of over-cautiousness, and not to promise even as much as they themselves expected. The new works at Greenock cost a large amount of money; but still the Greenock gas undertaking was relatively the lowest capitalized concern in the country; and he would like to impress upon his hearers the necessity of keeping-down capital expenditure. It was quite unfair to say that one undertaking had not done so well as another until full consideration had been given to the conditions under which each undertaking worked; and capital expenditure had more to do with the apparent difference than working. He congratulated the Council of the Association on the three visits arranged for the present session—viz., Greenock with its installation of Woodall-Duckham verticals; Johnstone, with its Wilson verticals; and Kilmarnock, with its Dempster verticals.

Mr. John Frazer (Dalmarnock Gas-Works) moved a vote of thanks to the Chairman.

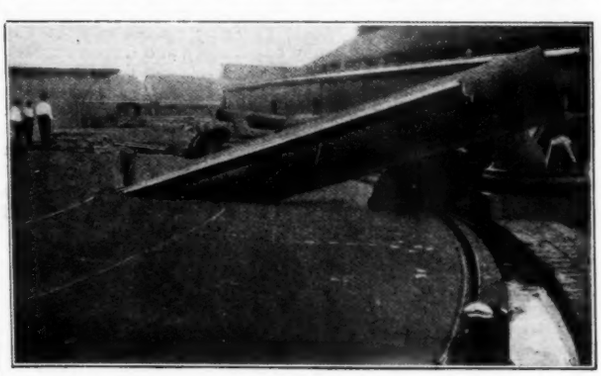
Mr. McGhee (Glasgow) thought that Greenock had nothing to learn as far as show-rooms were concerned either from the Second City of the Empire or from some of the North of England towns whose show-rooms had been so much talked about, and which he had had the pleasure of visiting a few months ago. He was very pleased to see the semi-indirect system of lighting adopted; and he recommended it as the ideal.

A STORM WRECKED GASHOLDER.

Gas Plant Damaged by a Gale at New Orleans.

According to "Gas Record"—a Buffalo publication—a very severe storm which visited New Orleans on Sept. 28 did execution around the gas plant, as shown by the accompanying reproductions of photographs. The wind, it is said, reached a velocity of 120 miles an hour, and damaged practically every roof in New Orleans. It also demolished an old gasholder (No. 6) having two

Superstructure of the New Orleans Gasholder Blown down by the Storm.



A Cast-Iron Column Punctures the Crown of the New Orleans Gasholder.

lifts and an underground tank of 500,000 cubic feet capacity. This was built in 1874 and partially rebuilt in 1909—a new curb, crown, and cups being installed. The holder contained gas at the time it was wrecked; but heavy rain prevented a fire. The 5 million cubic feet holder recently built by Messrs. Wood and Co. was full at the time; its five lifts extending about 250 feet in the air. This stood the wind without any apparent damage, as did the 1 million cubic feet holder by its side. The hurricane sweeping through the narrow space between the holders found the gateway of the plant in its path, and the men coming to work upon entering were literally blown into the yard.

THE DEPENDENCE OF THE LIGHT OF THE HEFNER LAMP ON ATMOSPHERIC CONDITIONS, MORE ESPECIALLY ATMOSPHERIC PRESSURE.

FROM THE LABORATORY OF THE SCHLIEREN WORKS OF THE ZÜRICH GAS UNDERTAKING.

By Dr. E. Ott, Member of the former International Photometric Commission.

[English translation by Mr. W. J, A. Butterfield, M.A., &c.]

Professor Dr. E. Liebenthal, Member of the Imperial Physical Technical Institute (Reichsanstalt) at Charlottenburg, proposed the following formula for the illuminating power y of the Hefner lamp—viz.:

$$y = 1{\cdot}049 - 0{\cdot}0055x - 0{\cdot}0072\,(x' - 0{\cdot}75) + 0{\cdot}00011\,(b - 760),$$

in which:

x = the volume, expressed in litres, which the aqueous vapour associated with 1 cubic metre of dry air free from carbon dioxide would have at the same temperature and same pressure;

x' = the carbon dioxide contained in the air expressed in the same manner; and

b = atmospheric pressure within the range 735 to 775 mm. of mercury.

On the other hand, W. J. A. Butterfield, F.I.C., J. S. Haldane, M.D., F.R.S., and A. P. Trotter, M.Inst.C.E., found the formula:

$$I' = \frac{100 - \left(\frac{a - A}{0{\cdot}16} + \frac{c - C}{0{\cdot}035} - \frac{p - P}{12{\cdot}5}\right)}{100} I$$

in which:—

I' = the varying light of the Hefner lamp expressed in terms of its light I in normal conditions;

a = the varying percentage by volume of aqueous vapour in the air;

A = the normal percentage of aqueous vapour in the air;

c = the varying percentage by volume of carbon dioxide in the air;

C = the normal percentage of carbon dioxide in the air;

p = the varying atmospheric pressure in mm. of mercury;

P = the normal atmospheric pressure at sea level.

y = I, and I' = I (1 Hefner unit, HK) when the Hefner lamp is burning in normal conditions—*i.e.*, with an atmospheric humidity of 8·8 litres of aqueous vapour; carbon dioxide amounting to 0·75 litre per cubic metre of pure air,* and an atmospheric pressure of 760 mm.

[* "Pure air" in the sequel always signifies dry air free from carbon dioxide.]

Mr. Butterfield communicated the results obtained in England to the International Photometric Commission at its third congress at Zürich in the year 1911. As the English formula contains a correction for the effect of carbon dioxide on the light of the Hefner lamp three times as great, and for the effect of ordinary fluctuations of atmospheric pressure a correction four times as great, as the German formula, the Commission expressed a desire that the researches should be repeated. The President (Professor Vautier) having suggested that this should be done at very different altitudes, in order primarily to ascertain the effect of atmospheric pressure, Director A. Weiss, of Zürich (who, unfortunately, has since died), and Hofrat L. Kusminsky, of Vienna, expressed themselves willing to undertake the task.

Owing to various circumstances, our laboratory could not put in hand this special work until the spring of 1914, after a lot of prolonged preparatory work had been carried out. The measurements were made by means of a portable equipment, which is described below, at the Jungfrau Joch station of the Jungfrau Railway (3450 metres = 11,319 feet above sea level, and with a barometer reading of about 500 mm. of mercury); at the Wengen Alp Railway Stations, Kleine Scheidegg (2067 metres = 6781 feet above the sea level, and 590 mm. barometer), and Lauterbrunnen (800 metres = 2625 feet above the sea level, and 695 mm. barometer); and in the potash mine "Alex," near Bollweiler, in Alsace (400 metres = 1312 feet below the sea level, and nearly 800 mm. barometer). A more favourable choice of experimental stations with more regular barometric differences could scarcely have been chosen; and the gas-works laboratory at Schlieren (about 400 metres = 1312 feet above sea level, and 727 mm. barometer) was in a suitable position to afford an intermediate controlling figure.

Unfortunately, however, these very laborious and tedious measurements showed an improbable course of variation in the light with the differences of height, which was, however, quite readily attributable to the distance in place and time between the experiments. The work had to be carried out in air of very different composition, often (on account of the small size of the room placed at our disposal) in particularly vitiated air, the effect of which on the measurements cannot be determined with sufficient certainty. The results were also liable to be affected unfavourably by the very different temperatures of the rooms, by the fact that the Hefner lamp frequently burnt in an unsettled manner, and by the repeated setting up, taking down, and transporting of the apparatus. To sum up, the results of the experiments undoubtedly demanded confirmation by an investigation made at one and the same spot, instead of in different places, in order that the determinations at varying atmospheric pressures should be carried out with air of the same quality as far as possible, and with no change being made in the apparatus in the course of a series of tests.

The recognition of this led, naturally, to the employment of a compression chamber. This consisted of a new iron vessel which had been ordered for other purposes, and in which the desired repetition of the measurements was carried out between Jan. 20 and Jan. 31, 1915. In contradistinction to earlier work, however, these investigations were made at only three different pressures—viz., at atmospheric pressure and at 100 mm. of mercury above, and 100 mm. of mercury below, atmospheric pressure—since this appeared to be sufficient to cover practical conditions, while the consequent curtailment of the experiments was an advantage from the standpoint of accuracy. The vessel also was thus not subjected to too great a pressure.

The compression vessel had a length of 6·20 metres (20·3 feet) and a diameter of 1·80 metres (5·9 feet). For practical reasons it was used in the upright position. It was provided with a manhole, and three tubulures for the air and electricity supplies, as shown in the accompanying drawing, which also shows the arrangement of the air-pump, the air-chests, and the connections. By suitable setting of the cocks, either a reduced or an increased pressure, or atmospheric pressure, could be maintained by the pumps and measured on a water-gauge. The pressures were quite readily maintained constant without any special regulator by throttling one or other of the cocks. The air was always passed in from the bottom to the top of the chamber, as in this way rapid removal of the vitiated air could be most easily and completely effected without eddies. The removal in this manner is facilitated by the natural upward movement of the air warmed by the observer and the flame. The air particles were given a parallel course through the compression vessel by the perforated plank flooring and the perforated plank ceiling, and consequently with an adequate supply of air the flame burned with normal quietness.

The position of the cocks shown in the drawing represents the method of working at a reduced pressure. In this case, in order to compensate for the cooling resulting from expansion, the air was warmed in the electric oven; so that the whole series of experiments could be carried out with fresh air at temperatures between 20° to 23° C. (68° to 73° Fahr.).

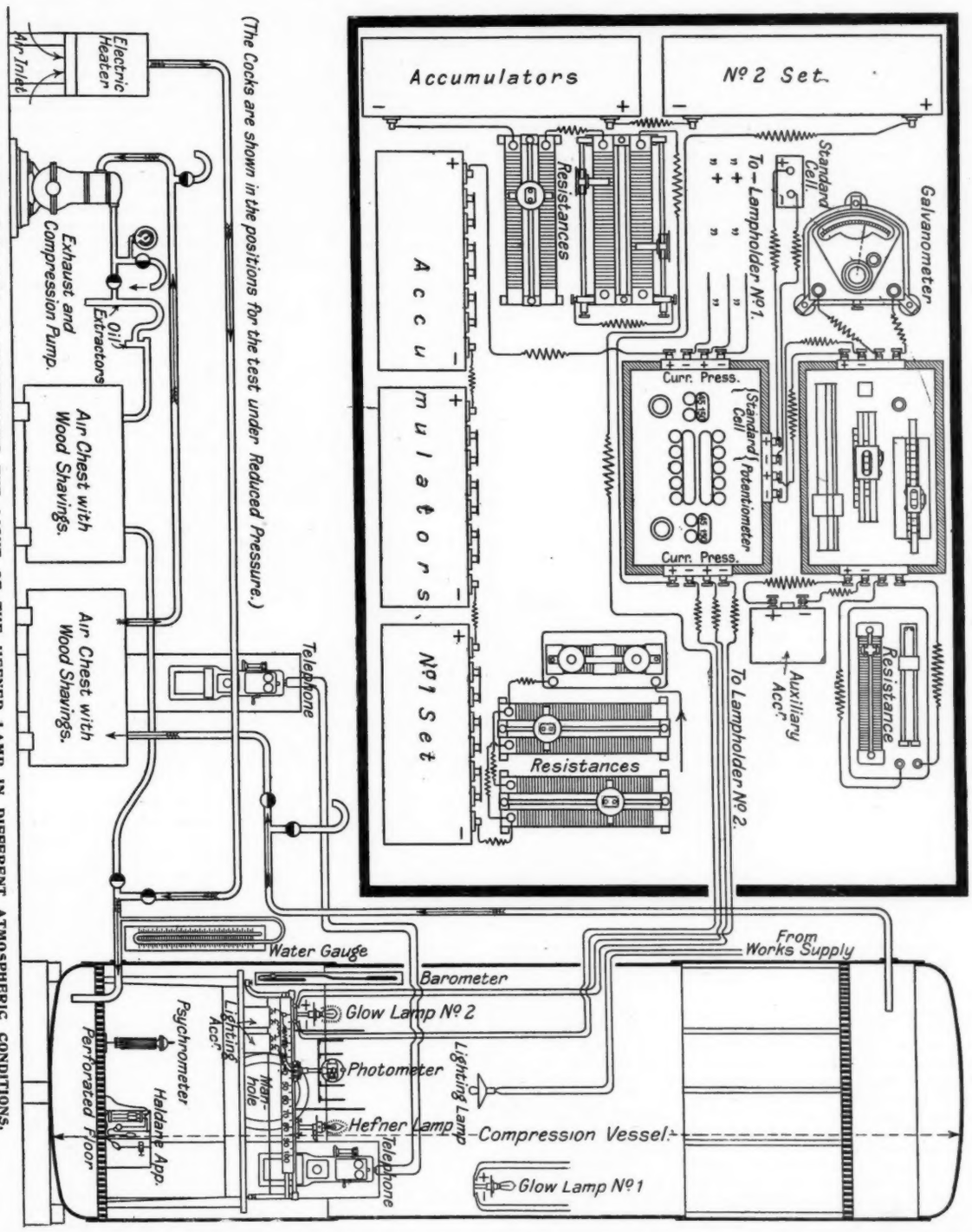
The pumps were also kept going during the experiments with pure air at atmospheric pressure. Thus the air was practically identical at increased and atmospheric pressure, and little altered in composition at reduced pressure. The contaminated air required for determining the effect of carbon dioxide and aqueous vapour was obtained by stopping the pump and allowing the products of breathing and combustion to accumulate, and by sprinkling hot water or spreading out dry calcium chloride. The maximum temperature thus attained was 24° C. (75° Fahr.). It must, however, be pointed out in this connection that an effect on the flame varying in degree took place according to the source of the vitiating constituents—viz., carbon dioxide and aqueous vapour—because the light is affected specially by the relative proportion of oxygen—*i.e.*, the ratio of oxygen to nitrogen. The more carbon dioxide and aqueous vapour arise through combustion (and not by mere admixture), the more oxygen disappears relatively to the nitrogen, and the more considerable is the loss of light.

Carbon dioxide, moreover, has considerably greater effect than aqueous vapour. This was proved by Bunte and Burschell twenty-five years ago [*vide* "Journal für Gasbeleuchtung," 1891, p. 310, *et seq.*], further reference to whose very interesting experiments will be made later.

The whole apparatus was installed in very favourable temperature conditions in the first condenser room of the No. 2 apparatus house of the gas-works. Pure outer air was always supplied to the pump.

A small table, which was fastened to the plank floor of the iron vessel, carried a short photometer bench, for comparing the Hefner lamp and the working standard incandescent lamp by means of a Lummer Brodhun photometer head of the equality and contrast pattern. Carbon filament incandescent lamps, with bow-shaped filaments and cylindrical glass bulbs were used, giving a light of about one Hefner unit at about 8 watts (20 volts, 0·4 amperes). These lamps had first been proved to be sufficiently constant on burning for at least 100 hours. They were compared from time to time with similar reference standard lamps, which were used but little and merely for control purposes. No considerable change of illuminating power was at any time observed, which tallies entirely with experience of them gained otherwise.

The tests were made with two incandescent lamps; but one and the same lamp was used throughout a complete series of tests at the three different pressures without being disconnected, in order to avoid disturbing the state of equilibrium of the apparatus. Any discrepancies between the readings of the scale on the photometer bench and the true distances between the incandescent filaments, photometer, and Hefner lamp, were neutralized by arranging that the photometer settings always fell about the middle of the distance of 80 cm. between the two sources of light; and as the latter also had nearly the same colour, the errors of measurement were reduced to a minimum.



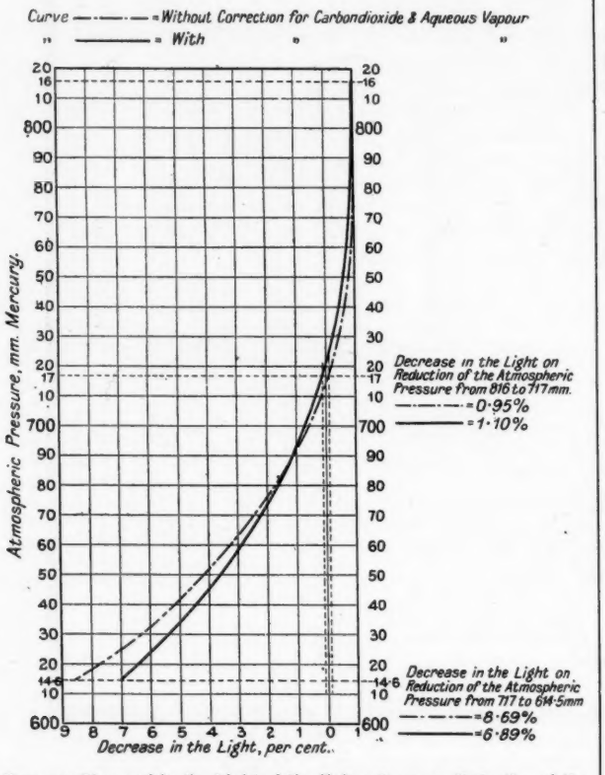
ARRANGEMENT EMPLOYED IN DETERMINING THE LIGHT OF THE HEFNER LAMP IN DIFFERENT ATMOSPHERIC CONDITIONS.

The current to the incandescent lamps was regulated from outside the compression vessel by means of a portable compensation apparatus which had been standardized at the Imperial Physical Technical Institute at Charlottenburg, and was found quite suitable for our purpose by Professor Liebenthal. It admitted of the strength of current and voltage being set exactly to 0·01 per cent., and therefore the illuminating power being fixed to at least 0·1 per cent. The compensation apparatus, supplied by the Land and Marine Cable Works at Nippes, Cologne, was specially arranged so that, by means of a positive switch, two lamps—viz., the one used in testing and the "reference standard"—could be controlled

with the required accuracy. A Weston cell, saturated at 4° C., and practically independent of temperature, was used as the standard cell. The rest of the arrangement can be followed from the drawing on p. 379.

The composition of the air was determined by physical volumetric methods as follows: The proportion of aqueous vapour was ascertained by the Assmann aspiration hygrometer [as recommended in Liebenthal's "Praktischer Photometrie," p. 117], and the proportion of carbon dioxide with the apparatus of J. S. Haldane, as recommended by Butterfield and described, *inter alia*, in the "JOURNAL OF GAS LIGHTING," Vol. CVI., p. 373. Both gave values in agreement with gravimetric methods. The latter, therefore, could be wholly dispensed with, which was especially advantageous, as they are not well adapted for work in conjunction with experiments which have to be carried through quickly, with rapid changes of pressure. Moreover, they would not have given results for a particular moment, as was absolutely necessary for tests beginning at any time. The use of the two methods together would have been much too troublesome and tedious. In order to obtain average values which should be as correct as possible, the following order of working was always observed: Reading the syphon barometer, determination of the carbon dioxide, determination of the humidity, reading the photometer, determination of the humidity, determination of the carbon dioxide, reading the barometer.

The equipment inside the vessel, which was coated dead-black, comprised, in addition to the barometer already referred to, a


Curve —·—·— = Without Correction for Carbondioxide & Aqueous Vapour
" ——— = With " "
Atmospheric Pressure, mm. Mercury.
Decrease in the Light, per cent.
Decrease in the Light on Reduction of the Atmospheric Pressure from 816 to 717 mm.
—·—·— = 0·95%
——— = 1·10%
Decrease in the Light on Reduction of the Atmospheric Pressure from 717 to 614·5mm
—·—·— = 8·69%
——— = 6·89%

Decrease Observed in the Light of the Hefner Lamp on Reduction of the Atmospheric Pressure from 816 to 614·5 mm. of Mercury.

series of screens, a telephone for intercourse with the exterior, and an incandescent lamp with convenient switch for lighting.

The readings of the photometer were made by the writer of this report personally, at such times as were indicated, by two other observers, who were keeping continuous control of the height of the Hefner flame (which was fed with amyl-acetate complying with the prescription) and of the intensity of the current and voltage of the incandescent lamp. A special device was found unnecessary for mixing the air in the vessel, on account of it being so narrow and the fresh air being in flow through it. Hence nothing more was necessary in the trials made with fresh air to ensure a sufficient admixture. When, however, the pump was stopped, the vitiated air produced was stirred with dusters; while the determinations of carbon dioxide and humidity were always made in the immediate neighbourhood of the flame, but screened from its radiation.

In order to render the solution of the particular question—viz., the determination of the effect of changes of atmospheric pressure on the light of the Hefner lamp—independent of disturbing factors—a transition was first made from atmospheric pressure (717 mm. on the average), through a pressure increased by about 100 mm. of mercury, to a pressure reduced by about 100 mm.; then from the increased pressure through atmospheric pressure to the reduced pressure; and finally beginning with the reduced pressure. In conclusion, an investigation was made with vitiated air under atmospheric pressure in order to determine the effect of carbon dioxide and aqueous vapour.

The results are summarized in the sequel:

1.—EFFECT OF ATMOSPHERIC PRESSURE.

(*a*) 816 to 717 mm. of mercury.

On changing the atmospheric pressure from 816 to 717 mm. of mercury with practically unaltered composition of the air—at the high pressure the air contained on the average 10·47 litres of aqueous vapour and 1·27 litres of carbon dioxide, and at atmospheric pressure 10·66 and 1·19 litres respectively per cubic metre of pure air—the sources of light being at the distance of 80 centimetres already mentioned, the photometer had not to be moved approximately 4 mm., which would have corresponded with the change of light of 4 per cent. ascertained in England, but on the average only by 0·95 mm., which corresponds with a decrease of light of 0·95 per cent. Taking into account the effect of carbon dioxide and aqueous vapour, according to the formula given below, the decrease rises to 1·10 per cent., which difference is, however, so small that it falls within the limits of experimental error.

It can therefore be stated with certainty that the decrease of light of the Hefner lamp through a diminution of atmospheric pressure of 99 mm. of mercury in the interval from 816 to 717 mm., which is the most important range from the practical standpoint, amounts to only 1·1 per cent., and that therefore the portion of Liebenthal's formula relating to atmospheric pressure corresponds with the fact.

Any other result was hardly to be expected, as the member of the formula in question had been obtained by the method of least squares from a sufficient number of observations made in a well-ventilated large room.

(*b*) 717 to 614·5 mm. of mercury.

At the change of pressure and an average of 12·65 litres of aqueous vapour and 1·34 litres of carbon dioxide in the attenuated air (the composition of the air at the atmospheric pressure of 717 mm. being as already stated above), the photometer had on the average to be moved 9·05 mm. towards the Hefner lamp, which corresponds with a decrease of light of 8·69 per cent. without correction, and of 6·89 per cent. with correction for carbon dioxide and aqueous vapour according to the formula given later.

This decrease is thus considerably greater than that found by Liebenthal in the pneumatic chamber. The difference is readily explicable by the fact that Liebenthal, according to his own account, did not secure quite satisfactory measurements because he was using a Weber photometer with a benzine standard.

It is of interest that the average decrease of light thus found over the whole interval from 816 to 614·5 mm. pressure is equal to that found by Butterfield, Haldane, and Trotter—viz., about 4 per cent. per 100 mm. decrease of pressure. But our points lie on a curve, and those of the other observers on a straight line. It may be mentioned that, further, two mean points at 763 and 663 mm. pressure fit in the curve referred to above. These measurements were obtained from the tests made in the spring of 1914.

2.—EFFECT OF CARBON DIOXIDE AND AQUEOUS VAPOUR.

As already explained, this effect depends not merely on the constituents themselves which cause the vitiation, but also on their origin. It could not therefore be determined so unequivocally as could the effect of atmospheric pressure. Experiments by Bunte and Burschell with the batswing burner, the argand burner, and the Hefner lamp, showed, in general, about the same effect from admixed carbon dioxide and admixed aqueous vapour as Liebenthal found; while these impurities, when occurring as products of combustion, lowered the illuminating power to a relatively much greater extent. Thus the carbon dioxide lowered it in a ratio which falls between that found by the Englishmen and that found by us.

Since an increase of carbon dioxide and aqueous vapour generally is accompanied by a diminution of oxygen, special experiments with mere admixture of carbon dioxide, as carried out by Liebenthal, do not represent what actually takes place. On the other hand, admixture of aqueous vapour, though of smaller effect, takes account of the change of natural atmospheric humidity. In any case in a formula applicable to the effect of vitiation of the air of a room the effect of the products of combustion and breathing must not be disregarded. Since, however, the ratio of the quantities of the impurities which thus come into account constantly varies, it is impossible at the outset to give a formula which will be correct for all experimental conditions. The formula expressed below therefore, strictly speaking, only applies to air of similar composition to that in our experiments; and therefore the changes of the light with variations in the atmospheric pressure have been stated above with and without correction for the vitiation of the air.

Our investigations have been mostly made at atmospheric pressure and with the aqueous vapour ranging from 9·93 to 21·19 litres and the carbon dioxide from 1·00 to 3·90 litres per cubic metre of pure air. For our experimental conditions the change of light per litre of aqueous vapour was 0·62 per cent. and per litre of carbon dioxide 3·30 per cent. Liebenthal found 0·55 and 0·72 per cent.; Butterfield, Haldane, and Trotter, 0·625 and 2·20 per cent.; and

an investigation made by Paterson, at the National Physical Laboratory at Teddington, on the effect of aqueous vapour, gave the result of 0·60 per cent. These differences, which are inconsiderable for aqueous vapour, are appreciable for carbon dioxide. They arise clearly from the fact that Liebenthal worked in a large room which was always well-ventilated, and determined the effect of carbon dioxide only by admixture of carbon dioxide from a cylinder; whereas the other observers carried out their investigations in small rooms with air contaminated by the products of breathing and combustion, and therefore relatively poorer in oxygen. It may be of interest to point out that the factor for the effect of carbon dioxide given by our formula is smaller than that of Butterfield, Haldane, and Trotter, but in any given case may be compensated by the larger factor for the effect of atmospheric pressure. This probably accounts for the difference in the factors for atmospheric pressure.

From the foregoing it undoubtedly follows that the factor relating to carbon dioxide of Liebenthal's formula is considerably too small, as in practice it is not generally a case of admixed carbon dioxide, but of carbon dioxide from breathing and combustion, if work is being carried on in badly ventilated rooms.

The formula based on our researches is as follows:

$$y = 1{\cdot}049 - 0{\cdot}0062x - 0{\cdot}033\,(x^{l} - 0{\cdot}75) + 0{\cdot}00011\,(b - 760)$$

in which the symbols have the significance already stated at the beginning of the report, only that b in this applies to the greater range of difference of pressure (816 to 717 mm. of mercury).

In this connection it must, however, be expressly pointed out that a different ratio of oxygen to nitrogen would also involve a more or less extensive alteration of the factors for aqueous vapour and carbon dioxide. The two members of the formula in question clearly can only be regarded as indicative, especially as the effect of these impurities is probably also to some extent dependent on the atmospheric pressure. For a final settlement of these factors a much longer series of investigations would still be required, as exact measurements with the Hefner lamp in themselves involve very ticklish work, which induces us, even in this connection, to express the hope that a steadier and more readily managed unit of light will soon be found.

The matter is different when the ratio of oxygen to nitrogen remains about the same, as is the case in working in well-ventilated and sufficiently large photometer rooms. Liebenthal's factors for atmospheric humidity and pressure apply specially to this case; and as they emanated from a sufficient number of observations, and moreover show good or very good agreement with our values, they may be accepted as correct. The factor for carbon dioxide must, however, drop out, and the measurements then apply to the average proportion of carbon dioxide of 0·75 litre per cubic metre of pure air given by Liebenthal for well-ventilated rooms.

In order therefore that work may be always carried on in uniform and well-defined conditions, and the light of the Hefner lamp be subject to proper corrections, photometer tests with it must always be made only in well-ventilated and sufficiently large rooms. The light is then only dependent on the natural humidity of the outer air and the atmospheric pressure, and may without objection be calculated according to the following abbreviated Liebenthal formula:

$$v = 1{\cdot}049 - 0{\cdot}0055x + 0{\cdot}00011\,(b - 760).$$

In this formula the symbols have the meanings given above, with b ranging from 816 to 717.

In conclusion, all who, directly or indirectly, participated in these researches are heartily thanked for their co-operation. It was only possible to carry through the work owing to the great interest which the former and present Managers of the Zürich Gas-Works—viz., the late Herr A. Weiss and Herr F. Escher—took in them throughout. Through them quite adequate grants for the work were without difficulty obtained from the authorities, represented in this matter by Councillors Fritschi and Kern. Great interest was shown also by the sending by Geheimrat Professor H. Bunte of Dr. K. Bunte and Dr. Hofsass to assist in the measurements at different altitudes. Further, mention must be made of Herr E. Fridori, Chemist by diploma, and Herren W. Grimm and H. Ringli, Engineers by diploma, as well as the laboratory assistant, Herr Ch. Schellenbaum. Finally, the specially valuable assistance of Herr Liechti, the Manager of the Jungfrau Railway, in arranging for setting up the photometer rooms and conveying the instruments must be mentioned, as also the granting of access to the Alex Mine, near Bollweiler, by Herr Jos. Vogt, the Manager, with the consent of Herr A. Schmidt, the Manager at Mulhouse, in Alsace.

Gas Industry of Japan.—In 1900 there were only two gas companies in Japan; but by 1913 this number had been increased to 75; the quantity of coal carbonized rising in the same period from 34,323 tons to 476,481 tons a year. In the latter year there were over 1000 miles of mains; while the lighting consumers were 43 times as numerous as in 1900, and consumers of gas for heating showed a much greater proportionate growth. At the same time, the percentage of profit on the paid-up capital employed in the industry shows a decrease from 19·7 per cent. in 1901 to 11·2 per cent. in 1913.

COKE-OVEN GAS FOR LEEDS.

To the traveller entering the City of Leeds by railway from the South at night time, two features have usually both attracted attention and denoted passing within the city boundaries. The first of these is the brilliant light, bathing the whole surroundings in its warmth and glow, which radiates from the huge cupolas of the Leeds steel-works. The second is the reflection—intrinsically far feebler, and dwarfed by comparison with the brilliance of the steel-works—of the flaring flames, looking like huge torches in the darkness, of the waste gas from the coke-ovens belonging to the Middleton Estate and Colliery Company.

In future the traveller will look in vain for the second of these reflections. Arrangements made some months ago for the purchase of the gas by the City of Leeds Gas Committee have now been carried into effect; and, instead of being burnt uselessly at the coke-oven vents, some million or so cubic feet of the gas will daily be passed through the plant of the Dewsbury Road Gas-Works, and thence on to be utilized by the gas consumers within the city limits.

For the transmission of the gas some 2¼ miles of 9-inch steel main, of No. 4 I.W.G. with long-sleeve welded joints, has been laid from Dewsbury Road to the coke-oven plant at the Middleton Colliery. As a portion of this main traverses areas which have been undermined by the colliery operations, and where, therefore, subsidence may be expected, lead jointed Kimberley collars have been inserted at suitable points in the length of main; and these have been enclosed within observation chambers so as to facilitate periodical inspection. The provision of high-pressure valves at approximately each successive length of 500 yards, renders it easy to carry out any repairs which may from time to time be necessary, without exhausting the whole length of main.

We understand that the Middleton Colliery Company are under agreement to deliver the coke-oven gas to the Dewsbury Road Gas-Works at a minimum pressure of 8 inches of water. This has necessitated putting down compressors at the Middleton end. The compressors installed are of the well-known rotary type of the Bryan Donkin Company, of Chesterfield, are steam driven, and (of course) in duplicate. Each compressor is capable of dealing with 50,000 cubic feet of gas per hour against a pressure of 54 inches head of water.

At the Dewsbury road end of the main, a blow-off pot, with a seal equal to 16 inches head of water, has been inserted; so that if, from any cause, pressures should build-up in the main, relief may be afforded before the gas enters the gas-works plant. To prevent the reverse of this occurring—namely, a passing of gas from the gas-works to the colliery, in the event of the compressors from any cause being thrown unexpectedly out of action—a flap-valve, suitably weighted, comes into operation on the gas-works, which automatically shuts off the main when the pressure falls below a certain minimum. After passing the blow-off pot and the flap-valve, the crude gas is measured by a station meter before being taken through the works exhausters.

As the quantity mentioned above—namely, one million cubic feet per day—is only equal to about one-fifteenth of the maximum daily output of the undertaking, there can, of course, be no question of undue reliance upon this source of supply. In certain eventualities, the danger of such reliance on the part of an undertaking with great public responsibilities needs no emphasizing. But, on the other hand, given a suitable price and quality, the value of such an auxiliary supply in the case of a large gas department is sufficiently obvious. Especially is this the case where, as in Leeds, portions of the manufacturing plant are undergoing reconstruction and rearrangement.

In order to avoid the inconvenience and dislocation which would probably ensue if there were wide irregularities in the quantities of gas sent forward, the stipulation has been made that the gas shall be supplied in regular hourly quantities, and of uniform quality. Recording calorimeters have been installed side by side on the gas-works for both the coke-oven gas and the mixed gases, so that the quality of the supply may be under continuous observation.

We are not at present at liberty to publish definite information as to price and quality in this particular case of Leeds. But we may so far lift the veil as to say that both minimum candle power and calorific value, and maximum nitrogen content, have been carefully specified in the agreement. Furthermore, a sliding-scale of prices, according to calorific value, has been arranged covering qualities between 400 and 600 B.Th.U.; and we believe that this has been so fixed as to give the Colliery Company a financial interest in maintaining a high calorific value.

The supply of the coke-oven gas has been proceeding for nearly a month now; and we understand from the Engineer and Manager (Mr. W. B. Leech) that so far the supply has been entirely satisfactory.

On the occasion of the first ordinary meeting this session of the Royal Society of Arts, to-morrow (Wednesday) afternoon, the silver medals awarded by the Council of the Society will be distributed. Among the recipients will be Mr. H. M. Thornton, J.P., M.I.Mech.E., who will receive a silver medal for his paper on the "Uses of Coal Gas for Industrial Purposes," read before the Society last March—see "JOURNAL," Vol. CXXIX., p. 743.

GAS-FIRE DEVELOPMENT 1913-15.

By HAROLD HARTLEY, M.Sc., Chief Chemist to the Richmond Gas Stove and Meter Company, Limited.

[A Lecture delivered to the London and Southern District Junior Gas Association, Nov. 12.]

In a lecture on the gas-fire delivered about two years ago to the Yorkshire Junior Gas Association, at Leeds University,* the development which had taken place since the initiation of the work of the Gas-Heating Research Committee was discussed. It is proposed now to continue with the theme, and to indicate and discuss the modifications with regard to gas-fire matters which have been introduced during the last two years. For the sake of continuity, the subject will be dealt with much along the lines taken in the earlier lecture.

DETERMINATION OF RADIANT EFFICIENCY.

On the occasion referred to we were able to show, as the result of work carried out in our Warrington laboratories, that the apparatus used in connection with the "Leeds" test was open to considerable objection. This, so far as we are aware, constituted the first published criticism of the "Leeds" apparatus. Firstly, a number of results were cited to show that the distribution factor for the gas-fire under test, when determined by means of the Rubens thermopile, would probably contain an appreciable error, and that, if comparative distribution results were to be obtained, a standard method of procedure must be decided upon and adhered to rigorously. Adopting such an expedient, it was indicated by the data published that the results obtained, while more accurate for the purpose, might still contain an error, owing to the inherent weaknesses of the Rubens pile. Since our original reference, attention has been called once again to the importance of the realization of the limitations of this thermopile, in a paper read recently before the Royal Society by Professor Bone and his co-workers.†

Then, again, it was mentioned that the "R.H.S." radiometer would not allow of accurate results being obtained. There has appeared recently in the Technical Press‡ an account in considerable detail of the experimental evidence which led to this assertion.

It appears to us to be essential that more reliable appliances should be used in connection with the "Leeds" method of gas-fire testing, and also that a detailed description of the method of carrying out a test should be published, so as to avoid errors such as are known to have occurred in the use of the original apparatus. For example, in the determination of the magnitude of the correction to be applied to compensate for the heat absorbed from, or emitted to, the surroundings by the absorbent surface of the radiometer under the conditions of test. We have felt that, owing to the universal applicability of the Leeds test, there might be objection to interference with the principle of the method, which appears to involve only two assumptions:

(*a*) That the thermopile readings taken at the centre of each of the areas of the hemisphere truly represent the mean density of the heat for each of the areas.

(*b*) That the conditions under which the readings are taken ensure their being strictly comparable.

Given suitable testing instruments these assumptions are correct, or so nearly correct as to be permissible.

The use of the Rubens thermopile especially invalidates the second assumption; so that it is desirable that a thermopile or similar instrument should be constructed which will be capable of giving comparable results under the conditions of test. The ordinary Rubens thermopile which we use, if placed in the o/o position in front of the ordinary 10-inch modern gas-fire, and connected-up to a sufficiently sensitive Paul unipivot galvanometer, can be made to give a centre reading of 30 without the necessity of employing the collecting cone normally supplied with the instrument. In the case of our own particular instrument, when exposed to the fire, the attached galvanometer needle will move steadily to the maximum, which is attained in 20 seconds. Further continued exposure of the pile to the source of heat results in a steady falling-off of the deflection.§ In the 1913 lecture, one instance was cited where negative values were obtained in the 80 west position during a test, after the pile had been exposed to the fire in the o/o position for some time. To eliminate this defect, the expedient was adopted first of water-jacketing the thermopile case. No better results were obtained, however, indicating that the trouble was not connected merely with the heating-up of the case of the instrument. We have constructed a thermopile in which we have been able to ensure that the decrease in the deflection which occurs with the Rubens pile shall not take place.

As an indication of the constancy obtainable with this instrument, we would draw your attention to the following figures, showing the deflection resulting when placed for an excessive period of time in front of a gas-fire under conditions which would produce a decrease in the galvanometer deflection with the Rubens thermopile:

Fire, 10-Inch Flat Fronted.

Time.	Deflection.
0 mins.	0·0
1 ,,	69·7
2 ,,	69·3
3 ,,	69·2
4 ,,	69·5
5 ,,	69·3
6 ,,	69·8
7 ,,	69·6
8 ,,	69·3
9 ,,	69·4
10 ,,	69·3
15 ,,	69·0
20 ,,	68·9
25 ,,	69·1
30 ,,	69·2

In carrying out the "Leeds" test, it should not really matter whether the centre of the fire is placed absolutely at the centre of the hemisphere or not. In fact, in the case of very many fires, it would be difficult to decide upon the centre of the fire. For example, are we to measure from half-way up the radiants or not? In few, if any, cases are the radiants uniformly heated; so that the "radiant centre" would probably be nearer the bottom than the top. Then, again, would the presence of a fender not affect the position of this radiant centre? Further, should one measure from the front or the back of the radiants, or half-way through the radiants, or even from the front of the bricks?

If, then, the position of the fire is to affect the accuracy of the results obtained by the "Leeds" test, one has first of all to discover the radiant centre for each pattern of fire; and in this case the method would be open to serious objection on practical grounds. The "Leeds" test aims at measuring the radiant energy at the surface of an imaginary hemisphere situated in front of the fire. If the latter is placed in such a position that all the radiant energy which, under normal circumstances, would come into the living-room, passes through the surface of the hemisphere, correct results should be obtainable. It is only in connection with the estimation of the energy as it crosses the hemisphere that assumption is involved in the "Leeds" tests; and the validity of the assumption will depend on the appliances used, rather than on the absolute position of the fire.

The following results obtained during tests with a fire serve to show that, in this particular case, the appliances used—a Rubens pile and a Richmond radiometer—gave concordant results, even when the fire was not set absolutely at the centre of the hemisphere. In each case all the effective radiant energy from the fire passed through the surface of the hemisphere.

10-Inch Bow-Fronted Fire.

Position of Fire.	Radiant Efficiency (Mean of Two Tests). Per Cent.
(A) Centre of radiants at centre of hemisphere.	44·2
(B) Fire lowered 2 inches from (A)	44·9
(C) Fire raised 2 inches from (A)	44·5
(D) Fire 2 inches in front of (A)	44·7
(E) Fire moved 2 inches east of (A)	45·5 (one test only).

The only absolute determination of radiant energy made during the "Leeds" test is the radiometer determination carried out in the o/o position. In using the Rubens thermopile for estimating the relative intensity of the radiant heat on the 81 areas of the hemisphere, we are assuming that the portion of each area really investigated is representative of the whole. In the case of flat-fronted fires, the results obtained are, in this respect, within the general limits of accuracy of the Rubens instrument. The general arrangement of the absorbent surface with reference to the inlet in this instrument is, however, far from satisfactory, with the result that a small displacement of the instrument will largely affect the galvanometer reading. Provided, however, that the pile is clamped so as always to face in the same direction throughout the test, the distribution factor for a flat-fronted fire situated at the centre of the hemisphere is but little affected. When the fire is markedly to one side of the centre, a noticeable deviation occurs.

Appended are some distribution figures $\left(\frac{\text{total}}{\text{centre}}\right)$ for the area between 10° north and 10° south for a 10-inch bow-fronted fire. The thermopile was used without a collecting cone.

Fire Position.

—	Central.	2 Inches to Right.	4 Inches to Right.
(1) Rubens pile facing centre	6·31	6·59	7·37
(2) Rubens pile turned slightly to right	6·38	6·46	7·06
(3) Rubens pile turned further to right	6·39	6·16	6·61

The setting of the pile in (3) was noticeably incorrect, and such as not likely to occur in actual practice.

The effect of the collecting cone on the factor given above is

* See "JOURNAL," Vol. CXXIV., p. 513.

† *Ibid* Vol. CXXX., p. 72. ‡ *Ibid* Vol. CXXIX., p. 316.

§ Attention must be called to the fact that this experience does not concur with that of Messrs. Bone, Callendar, and Yates, who state: ". . . the deflection rises to about 25 mm. in 15 to 20 seconds, and creeps up to 27·5, a further 10 per cent., in 3 or 4 minutes. The deflection then diminishes to about 25 mm. if the exposure is prolonged on account of rise of temperature of the case, which may amount to 5° or 10° C."

indicated by the following—thermopile facing centre of hemisphere:

Fire Position.

—	4 Inches to Left.	2 Inches to Left.	Centre.	2 Inches to Right.	4 Inches. to Right.
Without cone	7·16	6·54	6·30	6·45	7·11
With cone	7·62	6·82	6·30	6·39	7·31

The type of error which may be introduced in a determination using a thermopile constructed on the lines of the Rubens instrument—apart from the defect indicated earlier, that the actual galvanometer readings may not be strictly comparable—is indicated in the above. The variation with the fire 2 inches to the east, due to the incorrect setting of the pile, is not so marked; and under these circumstances (as already indicated) concordant efficiency results are obtainable. In the case of the fire experimented with, which was almost flat-fronted, it is only when the appliance is definitely set well away from the centre of the hemisphere that the error is noticeable. Nevertheless, the method of test should not be dependent upon the manner of heat distribution. If possible, the thermopile should be so constructed as truly to represent the relative heat density at the various points over the whole surface of the hemisphere, both under any conditions of distribution and for the complete range of radiant intensity produced by the varying sizes of fires. Even though concordant results may be obtained with the Rubens thermopile, it is apparent from the above that a constant error dependent upon the size of the radiating surface may nevertheless be introduced.

Radiometer.

A detailed description of the Richmond radiometer was published in the "Journal"* some few months ago. The instrument is simple in form, consisting of an absorbent body—a metal block of known specific heat—suspended in a suitable enclosure. Determinations of the change of temperature of the block are taken prior to, during, and after exposure to the fire. The results obtained enable the centre reading for the "Leeds" test to be computed. A radiometer test can be completed in less than 20 minutes; so that by its use an appreciable saving of time in the testing of a fire can be effected. Highly concordant results can be obtained by the use of this instrument in connection with the "Leeds" method of test, and it overcomes the various errors introduced by the use of the R.H.S. radiometer.

On the whole, with the new radiometer we obtain somewhat lower centre readings than resulted from the use of the R.H.S. radiometer. On the other hand, with the new thermopile we would appear to obtain somewhat higher distribution factors. The net result will be in all probability that the general efficiency figures will be found to be somewhat lower than those obtained with the original Leeds apparatus.

The Hygienic Standard.

During the last two years, we have seen the universal adoption of a more stringent hygienic standard with relation to the products of combustion from the gas-fire; and it is gratifying to think that this development was initiated internally, and was not forced upon us by external opinion. Although at first contested by a certain manufacturer on the ground of principle, the case in favour of the departure, already strong, appeared to me to be indisputable when we were able to show that, by proper canopy construction, high canopy fires could be made fume proof.

Out of the controversy concerning the escape of products of combustion from gas-fires under certain ideal conditions there has crystallized a simple standard test, which possesses the additional merit that it comes from an independent source. The test is that now known as the "Lancet" test, with which you are all familiar.

With regard to the actual hygienic standard, fires have been constructed which pass the "Lancet" test unaided by any chimney pull. In May, 1913, Richmond and Co. submitted for examination a series of fires, all of which were found to pass the test unaided when standing in the middle of a room. After reporting the result of their test, the "Lancet" stated, with regard to the standard, ". . . for ourselves we are inclined to accept that, when by an open test a gas-fire shows no leakage with (say) a 2 feet flue attachment (supplied by the makers of the fire), all that is required by hygienic consideration has been done."

Attention is called to this competent expression of opinion, owing to the tendency of manufacturers to adopt excessively large flue outlets in their endeavour to make the fires pass the "Lancet" test when standing in the middle of a room—a stringent condition.

Having conceived of the ideal, it was naturally more easy to attain this with a low-canopy gas-fire than with a high-canopy fire. With a low-canopy fire, however, the additional air which passes through the flue outlet along with the products of combustion may be compelled to pass over the upper portion of the radiants; and in that case there will result a decrease in radiant efficiency under chimney pull. On the other hand, with a high-canopy fire, provided the flue outlet is sufficiently small, it can be ensured that the fire shall not suffer in radiant efficiency when under the influence of chimney pull. If, however, even with high-canopy fires of the types at present made, the flue outlet be increased unduly, the constructional advantage of the high canopy is destroyed. For example, fig. 1 shows the section of a fire which passes the "Lancet" test unaided by chimney pull, and does not suffer in radiant efficiency when subjected to chimney pull. The size of flue outlet is 10 in. by 1⅜ in. If, however, the flue outlet is increased to 11½ in. by 3⅛ in., the efficiency of the fire is then affected by chimney pull, and a drop in efficiency of 2 per cent. results (from 54 per cent. to 52 per cent. in the actual test) when the fire is subjected to the pull of the chimney in the test-room. The distance from the canopy inlet to the top of the radiants in this particular fire is 4½ inches. Then, again, considering merely the framework of the fire, the canopy is, in many cases, the hottest portion exposed; so that if an excessive amount of air is allowed to pass along with the products of combustion, this part becomes unduly cooled, with the result that there is a decrease in the small amount of convected heat otherwise available.

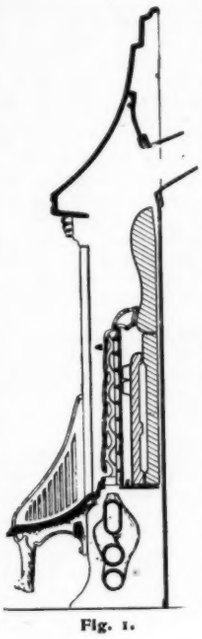


Fig. 1.

It is gratifying to notice that the high-canopy fire constitutes the major portion, if not the entire portion, of the new types of fire constructed by various makers. This type of construction is commendable on all grounds; but it is essential that the development shall not bring in its train large flue outlets. These are not advisable in conjunction with the present-day gas-fire, even though they may have an advantage to commend them when the fireplace is sheeted-up completely, without provision for ventilation.

The provision of a large flue-outlet will in most cases, despite a high canopy, involve an excessive decrease in the thermal efficiency of the fire when the latter is in actual domestic use. In order to oust the coal-fire more completely, it will not be sufficient merely to rely on the concomitant advantages of the gas-fire, but will be necessary to produce an appliance which shall show an advantage over its rival in actual fuel costs in prolonged use. To attain this ideal, it is essential that the gas-fire manufacturers on their part shall conserve to the best of their ability the thermal energy available, and, if possible, only allow heat to pass into the chimney after it has yielded the maximum of useful work.

Convected Heat and the Gross Thermal Efficiency of Gas-Fires.

It can be calculated that, roughly speaking, 75 per cent. of the thermal energy of the gas is available for distribution as radiant energy, assuming that the fire is incandescent to the top of the radiants. To attain this 75 per cent., it is essential that there shall be no excess of air passing through the radiants, and no transmission of heat through the back of the fire. The practice is general to estimate directly the radiant efficiency of a gas-fire, determine the flue heat, and assume that the residue is available as convected heat. In extremely few cases will this apply. In the case of rooms where it is necessary to ventilate by means of the fireplace, the proper fitting of the fire would involve a considerable increase in the direct chimney heat beyond that indicated by the flue loss determination. Even in the majority of the cases where the regretable practice is adhered to of blocking-up entirely all secondary inlets to the chimney place when the gas-fire is fitted, there is a considerably greater amount of heat passing up the chimney directly than is estimated under the head of flue loss. If any ordinary pattern of fire which has been alight for some time is examined, it will be noticed that the back casting is hot. The area of the back casting is, in many cases, as great as, if not greater than, the area of the front casting of the fire, and in addition it is also markedly hotter. So that, even if the heat emitted by radiation from the back casting were negligible, it is apparent that the figure given as convected heat, under the conditions cited above, must at least be divided by two, as the heat from the back casting passes directly up the chimney in nearly every case. Suppose the radiant efficiency of the fire to be 50 per cent., and the flue heat under chimney pull 30 per cent., we have a residue of 20 per cent. It is apparent, therefore, that of this residue not more than half—namely, 10 per cent.—can be available as convected heat. Actually, I believe that the convected heat is appreciably less in amount than this in the majority of cases. The gross heating efficiency of the majority of fires is less than 60 per cent.

Owing to the unsatisfactory conditions produced by the older types of gas-fires, which heated to a considerable extent by convection, there has resulted the production of an appliance which gives off a very small amount of convected heat. At times in rooms heated by gas-fires the temperature of the air is raised rapidly owing to unsatisfactory ventilation, and there are produced air conditions somewhat similar to those resulting from primary convected heat—in this case due to a secondary effect. Suppose the ventilation is satisfactory and the gas-fire is con-

* See "Journal of Gas Lighting," March 30, 1915.

suming 30 cubic feet of coal gas per hour, and that an additional 5 per cent. of the available energy could be transmitted to the room as convected heat, is it contended that the effect of this additional 5 per cent. will be harmful? It would be equivalent, from the thermal energy point of view only, to having alight in the room one bijou incandescent fitting consuming 1½ cubic feet per hour. In any case it will probably be desired for the temperature of the air of the room to be raised to (say) 63° Fahr.; and such a heating of the air will involve thermal transmission by convection. Surely, therefore, it is permissible to assume that some convected heat is allowable for this purpose, apart from any consideration of increased air movement. It is not inconceivable that the amount of convected heat allowable may be directly connected with the amount of radiant heat supplied, and that, as the radiant efficiency of the fire is increased, more direct convected heat may be admitted without producing unwholesome conditions in the living-room.

For these reasons, it appears to be advisable to retrace to some extent our footsteps in gas-fire construction, as—intentionally or otherwise—the over-all thermal efficiency of the modern gas-fire s determined almost entirely by its radiant efficiency. Of the energy available from the coal gas we can better afford to have, at any rate, a portion of it in the room as convected heat than up the chimney as chimney heat, assuming, of course, that the energy cannot be obtained primarily as radiant heat. From 5 per cent. to 10 per cent. of the total energy available, which is now transmitted directly to the chimney, can be recovered simply as convected heat. It may then be possible to approach the point of over-all thermal efficiency of 65 per cent. in the case of the best fires, fitted as is generally done. Adequate ventilation will probably provide the quietus for the now over-rated convected heat bogey.

Ventilation.

The formation of a Committee and the initiation of the ventilation research at Leeds University has attracted the attention of manufacturers, and there are now fires on the market which have been designed more especially for the purpose of satisfying those methods of fitment which necessitate the provision of ventilation arrangements on the stove itself. In the case of our own fires, there are three simple methods available for providing such ventilation arrangements:

(1) The provision of sufficiently large inlets to the dead-space between the two canopies, resulting from the adoption of the type of canopy construction which we advocated two years ago.
(2) The provision of air-ports at the edge of the fire.
(3) The adoption of a largely increased flue-outlet.

The adoption of systems (1), (2), or (3) will be determined by consideration of:

(*a*) The ventilation effect available or desirable.
(*b*) The additional thermal losses involved.

Unfortunately, competent opinion is divided on the question of the amount of air required for ventilation; and even if it were settled that there should be x changes of air per hour, no two rooms would provide identical conditions. Speaking generally, the coal-fire which we desire to replace does not noticeably over-ventilate the room; so that we shall probably be going on safe ground if the fire is so constructed that the effect produced is near the maximum possible with the average house chimney.

The following factors will affect the ventilation occurring in a given room:

(*a*) The resistance to the inflow of air to the room.
(*b*) The resistance to the inflow of air to the chimney.
(*c*) The resistance to the flow of air through the chimney.
(*d*) The chimney heat available.
(*e*) The internal heat available owing to the warming of the air in its passage through the room itself.
(*f*) The aëro-motive force due to the movements of the external atmosphere.

Of these, only (*b*), (*d*), and (*e*) can be controlled, in any way, at the stove. With regard to (*b*), this is determined by the area of the inlet to the chimney, in those cases where the openings are simply in the nature of one or more orifices in a thin plate. If the inlet is in the nature of a passage, it will be influenced by the design of the passage. The attainment of the best design in this case might be a troublesome matter. It is simpler to make the inlets of the type of thin plate orifices. The maximum ventilation is often obtained when the fire is set at the foot of a chimney without the fire-place being blocked-up in any way.

Coal-Fire Conditions.

To understand the conditions existing, it will now be worth while considering the case of the coal-fire, which may be found discussed in detail in some of the standard works on ventilation. In this case, the total resistance to the air flow through a room is made up of the resistance of the inlets R_1 and the resistance of the outlets R_0. If the aëromotive force is represented by A, and is assumed to be constant, the ventilation V is given by the equation:

$$A = (R_1 + R_0)\, V^2$$

But the A.M.F. "A" is determined by the relation between the temperature outside T_0 and the temperature of the flue T_f, and in any particular case, assuming T_o is constant, can be given by:

$$A = k\,(T_f - T_o).$$

If H = the total heat available.

$$T_f - T_o = \frac{cH}{V}$$

Where c is a constant depending on the specific heat of the air and the units employed.

$$\therefore A = \frac{KH}{V} \quad (K = kc)$$

$$\therefore \frac{KH}{V} = (R_1 + R_0)\, V_2$$

$$KH = (R_1 + R_0)\, V^3$$

If the inlets to the room are so large that R_1 is negligible, we get maximum ventilation.

$$V = \sqrt[3]{\frac{KH}{R_0}}$$

With the doors and windows closed and the air entering by chinks, the ventilation is at the minimum given by:

$$V = \sqrt[3]{\frac{KH}{R_1 + R_o}} \quad \ldots \quad (a)$$

From these relations, it follows that it will be a difficult matter largely to increase the ventilation taking place by increasing the chimney heat. The heat supplied would require to be increased eight times to double the ventilation. Further—and this is of importance to gas-fire manufacturers—cutting down the direct losses at the chimney will affect the ventilation to a considerably smaller degree, especially as it is to be remembered that of the heat emitted to the room by the fire a considerable portion passes eventually into the chimney. With a given difference of pressure, the flow varies as the area of an orifice. But, as mentioned, the square of the flow is proportional to the pressure, therefore, $V^2 \propto a^2A$ when a is the area of the thin plate orifice. Thus, doubling the effective area of an inlet will decrease the resistance of that port to ¼, and by definition $R = \frac{1}{ca^2}$ where c is a suitable constant.

Ventilation by Means of the Gas-Fire.

Now, of the three systems of ventilation mentioned previously the conditions for (3) are similar to those of a coal-fire, but with (1) and (2) are slightly different. By noting the increase of air flow resulting by increasing the subsidiary inlets in system (2), we obtain results which, when plotted to show the relation between the total area of the chimney and the total ventilation taking place, give a curve of the form shown by the full line in fig. 2.

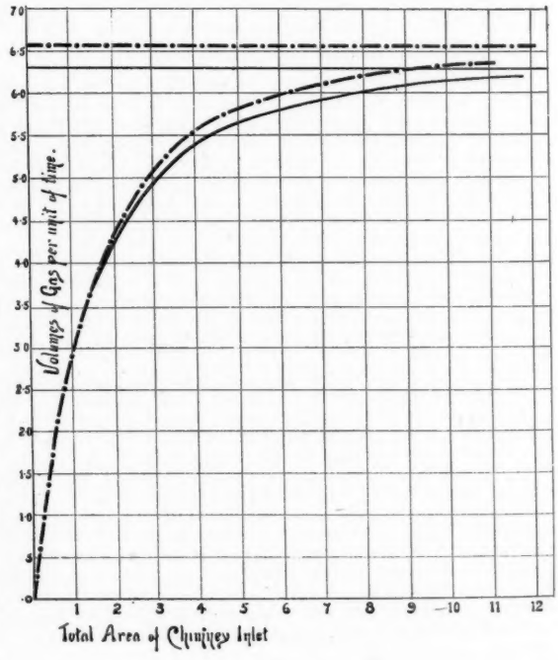


Fig. 2.

On the same diagram, there is shown a curve [broken line] calculated for the case of a gas-fire ventilating solely by means of the flue opening—the condition analogous to that of the coal-fire. The horizontal lines represent the maximum ventilation that is attainable when the resistance of the inlet to the well at the bottom of the chimney has fallen to zero. These curves have primarily a theoretical basis, and have been applied to an experimental chimney which discharged inside a lofty room in which the tests

were made. The conditions were thus such that the question of the entrance of air to the room had not to be considered. The units of area and resistance taken are those of a 3-inch square opening in a thin plate.

In fig. 3, the results for the fire with the subsidiary openings are analyzed, and the type of variation in the amounts of air passing through the flue-outlet and the subsidiary openings are indicated. Starting with the subsidiary openings closed, the total ventilation passes wholly through the flue-outlet. As the subsidiary openings are increased, a point is soon reached at which equal quantities pass through the flue and the openings. While increase in the side openings swells the total amount of ventilation occurring, the actual amount passing through the flue-outlet

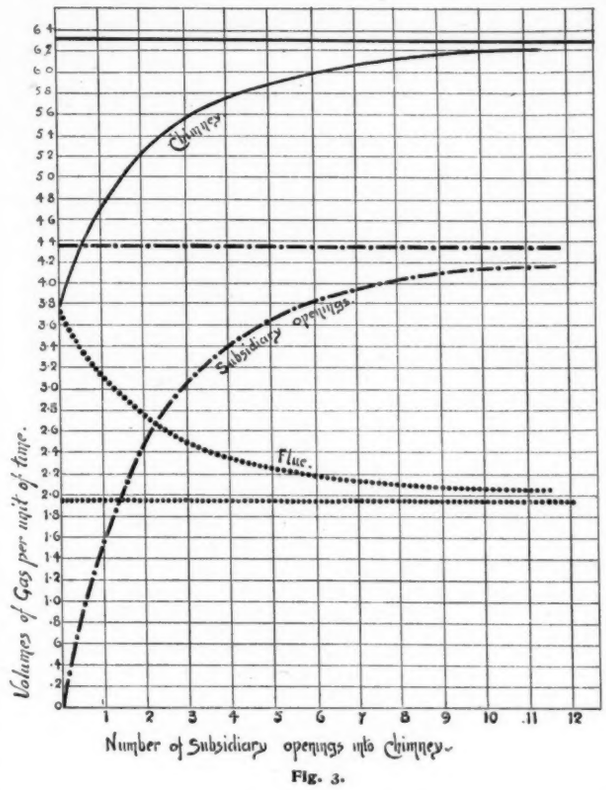


Fig. 3.

progressively decreases. The total ventilation, which is equal to the sum of the amount passing through the two inlets, is given by the full line curve marked "Chimney." If it is desired that the ventilating air shall not be drawn through the flue-outlet (and one of the chief reasons for employing subsidiary openings is to avoid this), then the desirability of having these subsidiary openings appreciably larger than the flue-outlet is emphasized by these curves. The asymptotes of each curve are also shown. Given a certain definite area of inlet, another advantage in making the flue-outlet as small as permissible, consonant with the satisfaction of the hygienic standard, and employing subsidiary openings for the ventilation, is that the A.M.F. of the fire itself will thus be kept as high as possible, and the effect of a momentary down-draught on the passage of the products of combustion up the chimney will be less marked. A fitting with a suitable flue elbow is also to be recommended on this ground.

Fig. 2 indicates that, viewed solely from the standpoint of moving air through the chimney, there is a small advantage in favour of the large flue-outlet and small subsidiary openings, as the broken line curve represents the limiting condition when the area of the latter inlets is zero. The magnitude of the difference between the results obtained by the two methods of ventilation is, however, dependent upon the length of the chimney-shaft, and, as given by the curve, represents the conditions for a chimney 14 feet long. With a longer shaft, such as would be met with in actual practice, or with an additional A.M.F. produced by some external agencies, the two curves would more nearly coincide. In the event of there being a shorter shaft, there would be more divergence than shown.

The difference between the results in the two cases is understood, when it is remembered that there are two distinct A.M.F.'s operating:

(1) That of the fire, dependent upon its flue loss, which affects its ventilation through the flue-outlet.
(2) That of the chimney-shaft, dependent upon the flue loss of the fire and the back casting loss, which produces the ventilation through the subsidiary openings, and also influences that through the flue-outlet of the fire.

In fig. 4 are shown graphically the results which would be obtained in shafts similar to the chimney under consideration, but

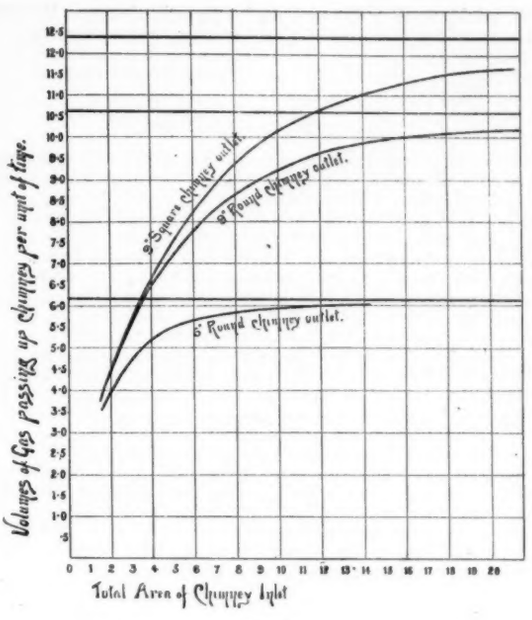

Volumes of Gas passing up Chimney per unit of time.
9" Square chimney outlet.
9" Round chimney outlet.
5" Round chimney outlet.
Total Area of Chimney Inlet

Fig. 4.

with outlets of three different sizes; these outlets representing the smallest cross section of the shaft. For the sake of the illustration, it is assumed that the smallest cross section represents the thin plate orifice area corresponding to the resistance of the chimney.

It is of interest to note that when the total area of the inlet to the chimney is equivalent to the thin plate orifice area corresponding to the resistance of the shaft, about 80 per cent. of the maximum ventilation possible with the chimney is obtained. In the case of the chimney with a 9-inch diameter circular outlet with a total inlet area of 7 units, ventilation of approximately 8·3 volumes was obtained out of a theoretically possible maximum of 10·6 volumes. If for some reason, such as the presence of bends, the resistance of the chimney is greater than that corresponding to the thin plate orifice of resistance equal in area to the outlet, the effect would be similar to that obtained with a correspondingly smaller outlet in the type of chimney which we have considered.

Resistance of Inlet to the Room.

So far we have only discussed the effect of chimney resistance. In an actual living-room we have operating, in addition, the resistance of the inlet to the room; and, in the majority of cases, this latter will not be negligible. It is, then, of interest to see what would be the effect of this added resistance on the efficiency of a gas-fire for ventilation purposes. In fig. 5, we have plotted against the room-inlet area, the ratio between the ventilation taking

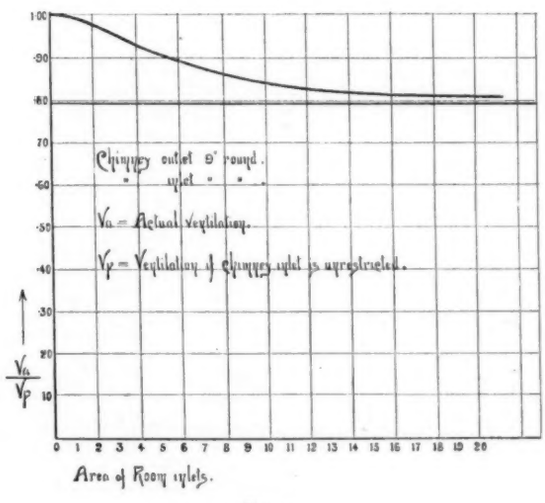

Chimney outlet 9" round.
" inlet " "
Va = Actual Ventilation.
Vp = Ventilation if Chimney inlet is unrestricted.
Va/Vp
Area of Room inlets.

Fig. 5.

place with a gas-fire with a resistance of inlet to chimney equal to the resistance of the chimney-shaft, and that possible with the same fire if it provided no resistance of inlet to the well at the foot of the chimney. The form of the curve is interesting, and indicates that with increasing room-inlet resistance the relative efficiency of the gas-fire as the ventilator increases from the 80 per

cent. minimum already mentioned, although, of course, the actual air transmitted decreases in amount owing to the extra resistance in the circuit. In other words, the greater the resistance of the inlets and the outlets to the room itself, the less important does the resistance of the fire become.

Analysis of Conditions.

Figs. 2 to 5 were deduced from an early series of experimental results which were found to be vitiated by certain errors due to (*a*) thermal losses from the chimney walls, and (*b*) unsuspected leakage of air into the chimney. The importance of these faults became apparent during the critical examination of the results, necessary in the endeavour to construct a general curve. The errors were greatest in the lower reaches of the curve, where the inlet areas were small and the chimney temperature relatively high. The curves were, therefore, deduced from the higher values, and represent a first approximation to the actual conditions.

The small difference noticeable between the actual results given in figs. 2 and 4 for the 6-inch round chimney are due to a small change made in the constants which are obtained from the final equation by trial. The preceding curves, however, serve their purpose, which is to indicate in a general manner the effect of the various operative factors on the results obtained.

For the purpose of the present lecture, it was felt desirable to repeat the critical series of tests on which the previous generalizations were based, taking precaution to overcome, so far as was possible, the errors given under (*a*) and (*b*) above. The actual experimental results are shown, together with the theoretical curve, in fig. 6. The concordance is surprisingly good, and justifies the use of the Pitot tube in conjunction with the Threlfall micromanometer, which we adopted, for determining the relative volumes of air passing in our tests. To emphasize the concordance, the observed and calculated values are tabulated below:

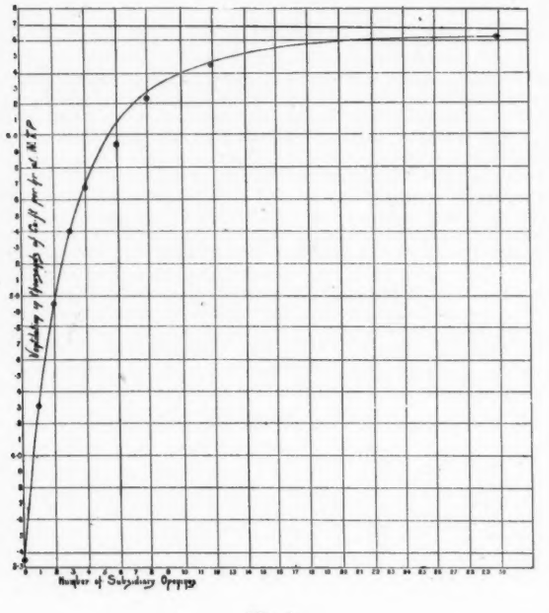


Fig. 6.

		Calculated.	Observed.
When a_s = 0	V =	3·345 ..	3·345
1		4·31 ..	4·31
2		4·96 ..	4·96
3		5·40 ..	5·40
4		5·70 ..	5·68
6		6·08 ..	5·95
8		6·28 ..	6·24
12		6·47 ..	6·45
20		6·60 ..	—
30		6·64 ..	6·64
Infinity		6·69 ..	—

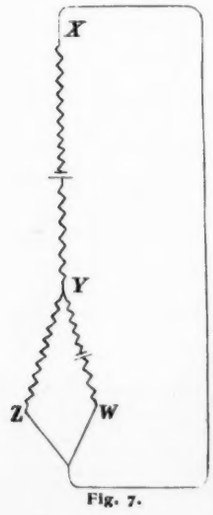


Fig. 7.

In fig. 7 is represented the electrical analogue of the system of ventilation by the gas-fire which we are considering. The seats of the A.M.F. are represented by cells, and the resistances by the zig-zag lines. The circuit is linked-up by plain lines of no resistance representing the surrounding atmosphere. This method of analysis of ventilation problems suggested by Shaw has enabled us to arrive at general equations representing the volumes of the ventilation through the various parts of the circuit.

Let V = ventilation through YX the chimney.
V_1 = " " ZY the subsidiary inlets.
V_2 = " " WY the fire flue outlet.
R_s = resistance of ZY.
R_f = " WY.
R_c = " XY.

a = A.M.F. in WY = $\frac{kH}{V_2}$ where H = flue heat.

A = A.M.F. in YX = $\frac{k^1H^1}{V}$ where H^1 = chimney heat.

Then it can be deduced that

$$V = \sqrt{\frac{\frac{kH}{V_2}}{R_f + \frac{R_s R_c}{(\sqrt{R_s}+\sqrt{R_c})^2}}\left[\frac{R_s}{(\sqrt{R_s}+\sqrt{R_c})^2}\right] + \frac{\frac{k^1H^1}{V}}{R_c + \frac{R_s R_f}{(\sqrt{R_s}+\sqrt{R_f})^2}}}$$

and

$$V_2 = \sqrt{\frac{\frac{kH}{V_2}}{R_f + \frac{R_s R_c}{(\sqrt{R_s}+\sqrt{R_c})^2}} + \left[\frac{R_s}{(\sqrt{R_s}+\sqrt{R_c})^2}\right]\frac{\frac{k^1H^1}{V}}{R_c + \frac{R_s R_f}{(\sqrt{R_s}+\sqrt{R_f})^2}}}$$

These equations are cumbersome, and for solution require four experimental points to determine the constants. They have been applied in plotting figs. 2 and 3.

The experience gained in this manner indicated a probable close agreement between the ventilation by system (2) and system (3). The latter can be represented by the more simple equation (*a*), already given; and it appeared quite likely, therefore, that by a suitable modification of constants, a similar equation sufficiently exact could be obtained for the system (2) under examination.

The curve fig. 6, which is in close agreement with experiment, is plotted by means of the relation which we have now derived.

$$V = \sqrt[3]{\frac{K}{R_c + \frac{1}{(a_s + a_f)^2}}} \quad \ldots\ldots (b)$$

Where K, the effective A.M.F., is dependent in any particular case on the heat available.

a_s = thin plate orifice area corresponding to the subsidiary inlets.

R_c and a_f are empirical constants determinable by experiment, and are roughly equal in magnitude to the resistance of the chimney and area of the flue outlet respectively. They may be defined as the effective resistance and conductance respectively of the two passages. By the determination of three points on the curve by experiment the constants can be derived and the full curve plotted.

The full line curve fig. 2 was calculated from the complicated relation previously given, assuming $R_c = 0{\cdot}100$ and $a_f = 1{\cdot}535$. On adapting the equation (*b*) to this particular curve, the values for the constants became $R_c = 0{\cdot}102$ $a_f = 1{\cdot}604$. Under these circumstances, the curves from the two equations will coincide. Although the equation representing the ventilation by the systems which we have designated (2) and (3) are similar, and the corresponding curves are of the same general shape, they are not quite identical, owing to the fact that the constants involved are different, due to the effect of the subdivision of the A.M.F., even although the actual conditions in system (2) where $a_s = 0$ are those of the system (3).

The Primary Essentials for Ventilation.

From what has been stated, it would appear that, in making provision for ventilation in gas-fire fitting, the following points should be observed:

(*a*) As large an inlet as practicable, to the well at the bottom of the chimney, should be made available.
(*b*) That the ventilation produced is practically the same whether it be done by means of a large flue-outlet or by subsidiary openings of equal effective resistance.
(*c*) That if subsidiary openings be employed, they should be appreciably larger than the flue-outlet of the fire.
(*d*) That when the effective resistance of the inlet is equal to that of the chimney-shaft, at least 80 per cent. of the ventilation possible with the thermal energy available can be obtained.
(*e*) That the rate of increase of ventilation with decrease of inlet resistance falls off rapidly towards the end of the curve, and that but little advantage accrues by increasing the inlet area beyond that of the effective cross section of the shaft.

[Note.—It is important that the effective cross section should not be confused with the actual cross section. By effective cross section is meant the thin plate orifice area, of resistance equal to that of the shaft.]

Distribution of Radiant Heat.

Progressive gas-fire makers endeavour persistently to increase the thermal efficiency of their appliances along lines which will ensure the attainment of suitable conditions in the living-room. Hitherto there has been no serious attention paid to the question of the manner of distribution of the radiant energy emitted by the gas-fire. Fires with vertical radiants have been to all intents

flat-fronted, with the result that it is found, on testing many of them by the "Leeds" method, that the horizontal distribution of radiant energy roughly obeys the cosine law. Thus, when the thermopile is moved through 60° to the right or left of the meridian, the intensity of the radiation is found to have fallen to about one-half. It would be advantageous to have a uniform distribution of heat horizontally in many cases, and in the case of a broad room to have, perhaps, even a larger proportion of the energy directed towards the sides of the fire than directly in front.

The "R.H.D." fire (fig. 8) introduced this year represents an endeavour to provide an appliance capable of giving a more nearly uniform horizontal distribution of heat, and in construction is a marked departure from the usual practice. By virtue of its property of giving more nearly uniformly horizontal heat dis-

Fig. 8.—The "R.H.D." Gas-Fire.

tribution, there has been eradicated a fault common to the coal-fire and to modern gas-fires. Obviously there are types of deeply-recessed grates in which there would be no advantage, but even a disadvantage, in fitting this fire. With the majority of grates it will be found, however, that the front line of the fire casting projects sufficiently beyond the back portion to enable the fire to fulfil its object economically.

Appended are results showing the variations in the intensity of the radiation as indicated by the Rubens thermopile during the "Leeds" test on moving from the centre to the sides of the fire in the case of the "R.H.D." gas-fire and an equivalent size flat-fronted fire.

	"R H.D." Fire (9 Radiants).					Flat-Fronted Fire (9 Radiants).				
Longitude.	0.	20.	40.	60.	80.	0.	20.	40.	60.	80.
20 S. .	25·2	24·8	22·5	17·4	4·3	39·0	37·5	32·1	18·7	3·1
Equator	29·6	29·0	27·4	22·5	11·4	43·8	42·2	36·8	23·3	5·5
20 N. .	31·0	30·5	29·7	26·8	15·2	42·3	40·9	35·1	22·7	5·2
40 N. .	27·7	27·4	26·9	23·4	13·4	35·0	33·4	28·0	17·1	4·0

Now, in this fire the radiants project beyond the line of the side casting; and we have to consider whether any disadvantage would attach to this, in view of the possibility of criticism on the score of cross draughts. The position in this connection may be summarized as follows:

(*a*) Fires have been in use for many years in which all of the radiants, vertical and top, project beyond the line of the side casting whereas in the "R.H.D." fire there is some side protection, and the top radiants end behind these side wings.

(*b*) All flat-fronted gas-fires standing in the middle of a room fail under the action of cross draughts when subjected to the "Lancet" test, even when aided by a flue elbow.

(*c*) Tests have been carried out with the "R.H.D." fire and different makes of flat-fronted fire standing side by side, each with a flue elbow attached; and it was found that in all cases where the "R.H.D." fire failed, as a result of bodies moving across the front of the fire, the flat-fronted fire also failed.

(*d*) If cross draughts occur in the living-room, they will in general be discontinuous and of short duration, due to the movement of persons across the front of the fire or to the opening and shutting of doors.

(*e*) The general air movement in the neighbourhood of the fire in use will be inwards towards the chimney.

(*f*) When a draught has been artificially produced locally across the "R.H.D." fire, the turning of the air stream in through the side ventilating ports is well defined in actual use.

Silent Gas-Fires.

The production of the silent "G.A.A." which we announced in 1913 rendered possible the production of the silent gas-fire for general use. It is at least fifteen years since there was put on the market a gas-fire burner capable of giving a silent flame at high aëration. Fires with this attachment were open to objection, however, on the score of the unpleasant hissing sound associated with them. The importance of producing a silent gas-fire is indicated by the following excerpt from the "Lancet:"

> "We hope that further attention will be given to the irritating noise made more or less by all atmospheric burners. This fact undoubtedly creates a prejudice against the gas-fire, and the greater the noise the greater is the impression that the gas bill is going to be big. In the sick room, where the gas-fire is of the greatest service, it is particularly desirable that the sound of the gas and air being intermingled and interjected should not disturb the rest or equanimity of the patient."

A Richmond silent gas-fire was tested, and that it was found to be satisfactory is indicated by the following:

> "We have had one of these silent fires under observation in a bedroom for several days, and the result is very satisfactory . . . .; and it seemed incredible that gas was being consumed at the rate of 30 feet per hour in a cherry red fire giving a genial warmth and comfortable aspect to the room."

Flame Silence.

Unless special provision is taken—as can be done by the insertion of a suitable device in the burner body or by making the capacity of the burner large—it is found that at high aëration the ordinary bunsen flame rattles. High aëration is not essential to the successful working of a gas-fire, nor, so far as our present knowledge of the subject allows us to say, is it advantageous. The degree of aëration necessary is determined at present by that required to prevent the sooting-up of the radiants—even a highly aërated flame will still cause a darkening of the gas-fire radiants. Sooting-up can be prevented by having in the flame, when the fire is hot, a defined inner cone which is not broken up by the radiant. This condition does not demand very high aëration.

There is a popular belief, which has been voiced recently in the gas industry, that flame silence can be obtained by ensuring good mixing of the gas and air passing to the flame. This view appears to me to be incorrect. Flame silence, just as jet silence, would appear to be dependent upon the elimination of objectionable eddies from the gas stream. This can be done simply by passing the mixture down a sufficiently long tube or by making the burner body ample. The following experiment shows the effect of eddies in causing flame rattle, and indicates that the phenomenon cannot be explained by any assumption of unsatisfactory mixing of gas and air: A piece of $\frac{3}{4}$-inch wrought-iron pipe about 26 inches long is provided with a drilled cap at one end. A short distance from this end there is drilled a hole in the side of the pipe. A gas-injector is attached to the other end of the pipe. Below the cap, and above the side hole, there are fitted two small screws which can be moved forward into the gas stream if required. With the screws drawn back, two silent highly aërated flames can be obtained at a suitable gas consumption. On moving the screws forward into the gas stream, the end flame can be made to rattle, owing to eddies set up in the pipe. That the obstruction does not interfere with the homogeneity of the mixture passing up the tube, is shown by the lower flame, which is unaffected and still burns silently.

Although flame silence can be obtained if the body be capacious, the resulting burner is cumbersome and possesses the objection that when the flame is extinguished there is a noisy explosion. To eliminate the eddies and, if desired, give flame silence at high aëration without the firing-back trouble, we have introduced in the gas-fire burner a metal grid built up of plates $\frac{1}{16}$-inch apart. This device produces the desired result, and has the advantage that the spaces in the eddy filter are so large as to avoid the collection of dust drawn into the burner along with the primary air, in the passages. The small pieces of fireclay that may at infrequent intervals fall on to the burner, cannot fall on to the grid, as the latter is not situated directly below the burner.

It is stated above that very high aëration does not appear to be necessary in the light of our present knowledge of domestic heating. It is often contended that the substitution of the highly aërated flame for the sluggish flame ensures an increase in the radiant efficiency. For this view we have not found support in the result of actual experiments. Tests which have been made at Warrington in this connection indicate that the change in radiant

efficiency, if any, is rather a decrease with the adoption of a highly aërated flame in the ordinary gas-fire.

Degree of Aëration.		Centre Reading K.C.U. per Hour.	Radiant Efficiency.
Fire (A)	High	67·9	46·6
		68·2	46·8
	Low	69·7	48·7
		70·0	49·0
Fire (B)	High	54·8	44·3
	Low	54·6	44·2

Further the distribution factor is but little, if any, affected by the change in aëration. In the case of fire (B) the distribution factors at high and low aëration were respectively 21·65 and 21·83. The centre reading represents the net balance of heat actually absorbed by a black body of 1 square foot area at a distance of 34½ inches from the fire.

General Details.

It is desirable to obtain as much radiant heat from a gas-fire as possible, and, if it can be done, to prevent radiant heat being transformed into convected heat before it is admitted to the room. In this respect a number of small additions can be made to the total effect by attention to details. In the ordinary "Art Black" stove with projecting canopy and fender, unnecessary losses of radiant heat are sometimes incurred. For example, the following results for radiant efficiency were obtained from such a fire. They show the saving to be effected by the use of suitable reflectors.

Description.	Radiant Efficiency Per Cent.
All black	51·0
Nickel-plated fender	52·0
No fender	52·5
Nickel-plated fender and nickel reflector under canopy	53·3

In conclusion, thanks must be expressed to the Directors of the Richmond Gas Stove and Meter Company, Limited, for permission to publish the data presented, which have been obtained from experiments carried out under my direction in the Research Department, and acknowledgment made of indebtedness to those members of the staff of the department who have assisted materially in the collation and interpretation of the facts given, by a frank expression of their own views.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Supply of Gas in War Time—Toluol—The Case of Small Works.

Sir,—It is not with any hope of official assistance from either the Government or the Institution of Gas Engineers (of whom I form a unit of membership), that I pen these lines in support of "Provincial Manager" in his recital of present-day difficulties to the small works manager in particular.

There is obviously a case for both. "Provincial Manager" has pretty well covered most troubles now arising in gas-works. The Gas Associations seem powerless to offer any practical assistance where it is most needed; while the Government for whom we are now labouring at some sacrifice, stand by at a time when the maximum supply of toluol is available, and allow all sorts of labour troubles—from the "cribbing" of men at higher wages rates, to Government supported demands for unreasonable wages advances—to interfere with the unfettered efforts of managers to really do their best.

Here is our own case. During the past eighteen months—*i.e.*, May, 1914, to November, 1915, stokers wages have risen from 31s. 6d. to 39s. 6d. per week; annual holidays have been granted; and time-and-a-half added to Sunday labour. A contract of service, embodying the agreed terms, was signed as recently as last April; and so long as it suited their book, the stokers held on to the agreement. We now have a demand for more wages, notwithstanding the signed agreement and the increase already of 8s. per week; and on refusing the demand, we are presented with notices from all retort-house men.

We accept the challenge, and agree to take our chance. We are not whining, and recognize the circumstances as part of the game. But, we are one of the small works that have loyally taken up the matter of toluol extraction, and spent some time and thought and supervision to obtain the best possible results. We have succeeded to the extent of getting two gallons of toluol extra per ton of tar, which normally contains less than half-a-gallon.

We have made certain sacrifices in carbonizing results—not compensated for by what the tar distillers offer us by the toluene. In fact, after correspondence lasting from last July, we are unable to agree with them as to the amount of toluene added per ton of tar. Their figures are less than half those of Professor Frankland. Some encouragement here!

As I previously said, we are a small works—under 30 millions per year. We shall carbonize 2700 tons of coal, and make 29,700 gallons of tar. In this tar we are placing 371 gallons of toluene by treatment, against 74 gallons in the tar untreated.

Unlike the gas engineer who came in for your editorial remarks last week, who wanted information in regard to the "C" process, we are doing everything possible to attain even better results than our present addition of two gallons of toluene extra per ton of tar. Some time and thought are being given to it, and some sacrifice of carbonizing results is being cheerfully undertaken by my Directors. Yet a body of men can deliberately wreck the whole scheme at a time when every gallon of toluene is most vital to the country and the maximum can now be obtained.

When I suggested to the Ministry of Munitions that gas-works should be declared "Controlled Establishments," under the present circumstances, I am simply referred to another department.

By the way, what has become of the unanimous resolution of the Midland Association of Gas Managers passed a few weeks ago—asking the Government to declare gas-works controlled establishments?

What several small works' managers would like to know is why the Institution of Gas Engineers cannot move and assist in such matters as:

(*a*) Preservation of labour at reasonable rates.
(*b*) Assist in a reasonable recognition by tar distillers of the value of our efforts in toluene extraction, when we have test figures by an acknowledged scientist to go by.
(*c*) Assist in obtaining badges and so retain indispensable distribution fitters. At present only those engaged on gas manufacture are granted service badges; yet what is the use of our making gas if we have not the means of maintaining its supply?
(*d*) Endeavour to obtain a declaration that gas-works are "controlled" for the period of the war, and so ease the labour troubles.

The British Commercial Gas Association took up a financial matter of great urgency for its members and laid some very sound arguments on the subject.

Just one parting shot as to the size of works which can reasonably adopt the "C" process. I recently saw a 14-million works at it; and they had bought and put in a small washer for the purpose!

These certainly are abnormal times, and we must not quibble too much. Still, there are certain aspects of gas supply in war time that are quite susceptible to smoother working by collective and authoritative representation.

There should be no question as to the size of works adopting the "C" process. If the plant is there, it should be used without any question.

A Small Provincial.

Nov. 12, 1915.

Sir,—With reference to your "Editorial Note," entitled "Toluol and Statutory Obligations—The Case of Small Works," in which you say that the size of works is immaterial, none being too small to help, I beg to express my disapproval of your statement unless qualified in the following manner: "No works having an engine and exhauster is too small to help."

Small gas-works with a make of under three million cubic feet per annum, where no exhauster is used, have the greatest difficulty in efficiently washing their gas for the extraction of ammonia, on account of the back-pressure; and were a tar-washer to be added to the plant, it would be almost impossible to get the gas through at all.

I mention this because there are many of these small undertakings throughout the country which are quite unable to render the assistance the "man in charge" would wish to give, though his patriotism, like Cæsar's wife, is far beyond suspicion.

C. G. Grimwood.

Sudbury, Suffolk, Nov. 11, 1915.

A British Trade Opening in Holland.

Sir,—We have now started our Gas Promotion Centre in Holland; and the first days of it give sufficient proof that it is a success. High prices for anthracite, and the fear for shortage in solid fuel, have an important influence on the promotion of gas for heating rooms.

We now intend starting the promotion of industrial gas. But the great thing is to get the appliances here. All sorts of furnaces, heaters, and burners have to come from the United Kingdom; and you know that all hands there are more than busy over munition work.

When your countrymen get to know what a large field for trade there is now here in Holland, they would come in shoals to take hold of the market. Whenever possible make British manufacturers understand that the man in the street here asks for British ware, instead of German articles. We will help them as much as possible in so far as concerns the gas industry and its appliances.

For instance, as to gas-fires. In our show-rooms we push English fires instead of the German types; and we cannot get enough of them to supply the demand. Make your British firms all of them understand that we wish to co-operate in every possible way in order to promote the beautiful system of heating with modern British gas-fires.

Hollander.

Nov. 6, 1915.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Lighting Regulations, London.

In the House of Commons last Tuesday, Mr. Hugh Law asked the Secretary of State for the Home Department whether, having regard to the regulations now enforced in the matter of domestic lighting, and with a view to diminishing the risk of street accidents and alleviating the gloom of London after nightfall, he was now prepared to sanction an increase of lighting by public authorities?

Sir J. Simon, in reply, stated that the lighting of London is regulated in accordance with advice given by those responsible for the defence of London from air raids; and while full consideration was given to the desirability of maintaining reasonable lighting, he could not disregard the advice under which he was acting. The matter was receiving close attention, and if any relaxation was found practicable it would be given effect to without delay.

Colonel Edmund Eaton.

Mr. MacCallum Scott asked the Under-Secretary for War whether he had seen the observations made by Judge Mackarness on the conduct of Colonel Edmund Eaton in a recent case heard at Hayward's Heath County Court (*ante*, p. 216); and whether any action had been taken in respect of this officer?

Mr. Tennant: My attention has been called to the observations made by the learned Judge referred to. I may state that the Judge himself wrote to the War Office. The case of Colonel Eaton is now under the consideration of the Army Council.

The Recruiting of Skilled Employees.

Sir G. Scott Robertson on Wednesday asked the Under-Secretary of State for War (1) whether recruiting officers were still in possession of orders directing them not to enlist skilled employees of electric power corporations, tramways, &c., without the written consent of the company, or had those orders been modified or withdrawn since July 12; and (2) whether he was aware that to ensure the carriage, to and from their homes, of workmen engaged in the manufacture of munitions of war at Bradford there must be retained in the tramway department of the Corporation an irreducible minimum of skilled artizans of military age after every possible substitution of older and less skilled men for those younger and more efficient had been made, and after reductions had been carried out to the limits even of wartime possibility. Could he now state whether these remaining necessary men will be granted an official badge to show they have been refused enlistment in the Army by the recruiting authorities on the ground of public expediency?

Mr. Tennant: The attestation of all such men as those mentioned has been authorized by the War Office. When attested, they will be placed in their proper group, and will not be called up unless and until, when their time comes, they are found to be no longer indispensable to their employers; but, in the meantime, the employers are required to take every step as far as possible to provide temporary substitutes for these men from men medically unfit, men too old for enlistment, or women. This arrangement has been agreed to by the various departments concerned.

Sir G. Scott Robertson: Is a special badge to be given to those men who have been recruited, but who, for the reasons stated, have not been enlisted?

Mr. Tennant: Yes, Lord Derby has in contemplation the giving of an armlet.

On Thursday, Mr. Samuel Roberts asked the Minister of Munitions whether he had power to prevent men engaged on electric power stations which supply munition works with current from being recruited; and, if not, would he take immediate steps to obtain wider powers for this and other undertakings essential to munition work being carried on?

Colonel Arthur Lee—the Parliamentary (Military) Secretary to the Munitions Department—replied that the Minister of Munitions has power to issue badges to indispensable men engaged in electrical power stations supplying current for war purposes. Badges had been issued in such cases wherever application had been made.

Municipal Expenditure.

On Thursday, the Secretary of Scotland was asked by Mr. Watt whether a circular was issued in August by the Local Government Board of Scotland advising local authorities to curtail expenditure on parks, recreation grounds, libraries, street lighting, and other objects, with the object of reducing local rates in view of the increased Imperial taxation due to the war. If so, would he say how many local authorities responded to the circular by reduction of their rates, and give the names of the local authorities, if any, that had increased their local rates, notwithstanding the appeal of his department?

In reply, Mr. McKinnon Wood said: Following an earlier circular dealing with another aspect of the same subject, the circular referred to was issued in August to some 2000 local authorities throughout Scotland rating for all kinds of local purposes, including those specified by Mr. Watt. A detailed reply on the points suggested could not be given without the issue of a further circular asking for specific information, and the time for such action had not yet arrived.

LEGAL INTELLIGENCE.

PUBLIC AUTHORITIES PROTECTION ACT.

Accident while Delivering a Load of Coke.

The House of Lords last Friday gave judgment in the case of *Myers v. Bradford Corporation*—the plaintiff being successful. The earlier arguments before the Courts were reported in the "Journal" for Dec. 16, 1913, and Nov. 10, 1914.

Mr. Myers ordered from the Corporation a ton of coke, and on the same day they sent a cart in charge of a carter in their employ to his premises with a view to delivering it. The man backed the cart on to the pavement, and tipped it in order to send the coke through the coal-hole in the pavement; but he so negligently managed it as to shoot the coke through a large plate-glass window. Mr. Myers did not commence an action to recover damages until May 7, 1913—more than six months after the accident; and the Corporation set up the statutory defence that the action was barred by the Public Authorities Protection Act, 1863, which provides that such an action must be begun within six months. The action came before the County Court Judge and a Jury in the Bradford County Court. The Jury returned a verdict for Mr. Myers for £17 2s. damages; but the Judge held that the case was expressly covered by the Act, and gave judgment for the Corporation. Upon an appeal being taken to a Divisional Court the learned Judges differed in opinion. Mr. Justice Bray was of opinion that the action was barred by the Act; while Mr. Justice Lush held that, in the circumstances, the Act did not apply. In the result the appeal of the respondent was dismissed. Against this decision Mr. Myers appealed to the Court of Appeal, with the result that it was directed that judgment be entered in his favour for the damages found by the Jury at the trial. The Court of Appeal unanimously held that, in the circumstances of the case, the Public Authorities Protection Act had no application; so the Corporation appealed to the House of Lords, where arguments were heard last July by the Lord Chancellor and Lords Haldane, Dunedin, Atkinson, and Shaw, when judgment was reserved. The sole question involved in the appeal to the House of Lords was whether or not the action was barred by the Act. On this point the respondent contended that in this transaction the Corporation were not acting in their capacity as a municipality, but as traders, and were not entitled to claim the protection of the Act.

The Lord Chancellor, having dealt with the facts of the case and with the Bradford Corporation Acts, said: It is not because the act out of which an action arises is within the power that a public authority enjoys the benefit of the Statute. It is because the act is one which is either an act in the direct execution of a Statute or in the discharge of a public duty or the exercise of a public authority. I regard these latter words as meaning a duty owed to the public or an authority exercised impartially with regard to all the public. It assumes that there is a duty and an authority which is not a public one, and that in the exercise or discharge of such a duty this protection does not apply. This distinction is well illustrated by the present case. It may be conceded that the Local Authority were bound properly to dispose of their residual products; but there was no obligation upon them to dispose by sale, though this was the most obvious and ordinary way. Still less was there any duty to dispose of them to the respondent. No member of the public could have complained if the respondent had not been supplied, nor had any member of the public the right to require the Local Authority to contract with him. The act complained of arose because one of the servants of the appellants, acting in the course of an errand on which they had power to send him, but on which they were not bound in the execution of any Act or in the discharge of any public duty or authority to send him in breach of his common law duty to his fellow-citizens, caused damage by his personal negligence. In my opinion, an action for such negligence is not within the class of action contemplated by the Statute.

Lords Haldane, Dunedin, Atkinson, and Shaw concurred; and the appeal of the Corporation was dismissed, with costs.

SEQUEL TO A GAS-STOKER'S STRIKE.

The Stoppage of a Supply.

Sheriff Lee, at Airdrie, has now given his decision in the action, raised in the Small Debt Court, by the Coatbridge Picture House, Limited, against the Coatbridge Gas Company, which was recently debated before him [see *ante*, p. 268]. The pursuers claimed £50, restricted to £20, in respect of loss and damage sustained by them on or about June 5, 1915, in consequence of the defenders' failure to supply them with gas, as they undertook to do, through their Manager (Mr. Thomas Wilson), whereby pursuers were obliged to refund to their patrons the price of their admission. The defence was that the action was incompetent. The Sheriff, after avizandum, has now dismissed the action, with expenses to the Gas Company.

In the course of his judgment, the Sheriff said the Gas Company was incorporated by a Private Act, which incorporates the Gas-Works Clauses Acts of 1847 and 1871. The pursuers based their claim, first, on the statutory obligation to supply, which they maintained established an ordinary contractual relation between the Gas Company and those whom they supplied; and, secondly, on a special undertaking alleged to have been given by the Company through their Manager. There was a strike of the employees of the Gas Company; and it was the failure of negotiations for the settlement of the dispute which led to a stoppage of the gas supply for a few hours. The Gas Company had been in existence for a great number of years; and there were similar companies all over the three kingdoms. Disappointments and losses through failure to supply must therefore have been fairly frequent; and it was probably enough for the disposal of this claim in the Small Debt Court that the pursuers could point to no precedent. The Small Debt Court was not the proper place in which to raise important questions of right by claims which, for the greater part of a century, had been tacitly accepted to be untenable. But the case might be disposed of on other grounds. Though there was not, he thought, any Scotch authority, the English Courts had decided against the pursuers' contention. In *Atkinson v. Newcastle Water-Works Company* [2 Ex. Div., 441], the question raised was not quite the same as in this case, because the breach founded on was one of a statutory duty to provide a public supply of water. But much that was said in the case was equally applicable to an action for failure of the duty to supply to an individual in return for private payment; and the matter was important as throwing doubt on the broad general proposition which appeared to have been laid down in *Couch v. Steel* [3 Ell. and B., 402], that "wherever a statutory duty is created, any person who can show that he has sustained injuries from the non-performance of that duty can bring an action for damages against the person on whom the duty is imposed." Lord Cockburn said: "The Act does not give by implication to persons injured by breach of duties thereby imposed any remedy over and above those which it gives in express terms. If, therefore, any person is injured by a breach of such duty, he must have recourse to the statutory remedy, and cannot maintain an action for damages." Following this was the case of *Clegg, Parkinson, and Co. v. Earby and Thornton Gas Company* [1896, 1 Q.B.D., 592], which exactly disposed of pursuers' claim. It was there held that an action would not lie against a gas company, to which the provisions of the Gas-Works Clauses Act, 1871, applied, for damages sustained by a consumer by reason of the failure to give him a supply of gas; and that the consumer's only remedy was to proceed for penalties under section 36 of the Act. *Morris and Bastert v. Loughborough Corporation* [1908, 1 K.B.D., 205] was in no way inconsistent with the cases to which he had referred. There the corporation, apart

from their duty to supply their own public, had power to contract for the supply of electricity with outside consumers. The plaintiffs, who were not entitled under the Act to require a supply, made an agreement with the corporation for one. It was held that an action for damages lay for breach of the agreement to supply; there being no clear words in the Statute confirming the remedy of the plaintiffs to proceedings to recover the penalty under the penalty clause of the Act. But Lord Alverstone clearly suggested that the decision would have been the other way if it could have been held that the agreement made was subject to the provisions of the penalty clause. He (the Sheriff) did not think the additional agreement of a special undertaking by the Manager affected the relevancy of the present claim. The duty to supply was already absolute under the provisions of the Gas Act; and no undertaking could enlarge it. If the pursuers could aver that the undertaking by the Manager was the foundation of their right to a supply, they might be able to bring this case within the principle of *Morris and Bastert*. But they could not aver this. They obtained their supply as one of the public whom the Company were bound to supply under compulsitor of the penalties that were provided for by the Act.

The action was dismissed, with expenses.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Nov. 12.

(*Before Mr. Justice* LAWRENCE *and a Common Jury.*)

Leigh v. Tottenham District Light, Heat, and Power Company.

In this case Walter Leigh, a nurseryman carrying on business at Lower Edmonton, claimed damages against defendants, who formerly carried on business as the Tottenham and Edmonton Gas Company, for alleged breach of contract for the supply of coke. By a contract in writing dated Dec. 18 last, Mr. A. E. Broadberry, acting on behalf and with the authority of the defendants, agreed with the plaintiff to sell him 100 tons of unbroken coke at 13s. 4d. per ton delivered between Dec. 19, 1914, and Dec. 16, 1915. It was said to be an implied term of the contract that defendants should supply the coke in such reasonable quantities, and at such reasonable time within the period, as the plaintiff might require; and that if defendants were at any time unable to supply coke, they should give reasonable notice thereof. The coke was required by the plaintiff for the purpose of heating his greenhouses. It was alleged that in breach of contract defendants on Feb. 10 wrongfully and without due notice refused to continue the supply of coke, with the result that the plants in the greenhouse were killed by the cold. Defendants admitted the contract, but said it was an express condition thereof that their liability to deliver coke was subject to their power to suspend the contract if they required the coke for the purpose of gas manufacture. Defendants did require all the coke which they produced for the purpose of gas manufacture; and on Feb. 10 they gave notice to plaintiff that they were unable to continue the supply of coke under the contract.

Mr. PATRICK HASTINGS appeared for the plaintiff, Mr. NEILSON for the defendants.

Evidence was given on behalf of the plaintiff that in February last defendants were selling large quantities of coke at a higher price than 13s. 4d. per ton; and it was suggested that putting an end to the contract was done for the purpose of earning extra profit. This suggestion was flatly contradicted by defendants. Plaintiff estimated his loss at £534—that being the value of 6800 plants which were destroyed.

His LORDSHIP ruled that the measure of damage for any breach of the contract must be the difference between 13s. 4d. and the price a person would have to pay to get coke in the market. Defendants were selling coke in February at £1 and £1 1s. 8d.; and if plaintiff had paid £1 1s. 8d. per ton defendants would have delivered coke to him.

In the result the Jury found for the plaintiff, assessing the damages at £200.

His LORDSHIP granted a stay of execution on the usual terms.

WORKMEN'S COMPENSATION ACTS APPEAL.

On Wednesday last the case of *Strange v. Davis Gas-Stove Company* came before the MASTER OF THE ROLLS and Lords Justices BANKES and WARRINGTON, by way of appeal on part of the plaintiff from the award of the County Court Judge at Luton. At the outset,

Mr. SHAKESPEAR, for the respondents, took the preliminary objection that the appeal would not lie, as the workman in whose favour the award was made had enforced the award by accepting the amount awarded. Counsel said the claim was brought in the County Court by the mother, as a dependant of her son, who was killed while in respondents' employ. The employers denied any liability, but paid into Court £60, which they said was enough to answer any claim. The County Court Judge made an award for £100, with costs; and, on the £40 and the amount of the taxed costs being paid into Court, applicant took it out, and then served notice of appeal to increase the amount. The Court had already decided, in *Johnson v. Newton Fire Extinguisher Company* and *Jones v. Winder*, that in such circumstances an appeal could not be brought.

Mr. LORT WILLIAMS, for the appellant, argued that the present case was distinguishable from those relied upon, as the facts were quite different. He was not seeking to quarrel with the award; all he said was that the learned Judge had awarded less than he was bound to do by the schedule.

Lord Justice BANKES: You cannot approbate and reprobate. If you are not quarrelling with the award, why are you appealing?

Mr. LORT WILLIAMS: Because the learned Judge has done something which, under the Act, he has no power to do. We accept the award so far as it goes, but the amount is not enough.

The Court upheld the objection, and the appeal was dismissed with costs.

MISCELLANEOUS NEWS.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary Meeting of the Association was held last Thursday, at the Cannon Street Hotel, E.C.—Sir CHARLES J. JESSEL, Bart., in the chair.

The SECRETARY (Mr. R. W. Wilson) read the notice convening the meeting; and then the Auditors' certificate for the half year ending June 30, 1914.

On the motion of the CHAIRMAN, the report and accounts for the half-year to June 30, 1914, were taken as read.

DIRECTORIAL CHANGES AND ABSENTEES.

The CHAIRMAN: I now beg to move—"That the report of the Directors upon the affairs of the Association for the half year ending June 30, 1914, which has been taken as read, be received, adopted, and entered upon the minutes." Ladies and Gentlemen, I have to commence what I have to say to you by referring to the effect of changes on the Board of Directors. Shortly after I had the pleasure of meeting you last May, our esteemed colleague Sir Chandos Leigh passed away. He had been a Director ever since Nov. 16, 1890; and had therefore been on the Board for nearly a quarter of a century. A great cricketer, a fine judge of horses, and a good rider, he was an example of a cultivated sportsman such as one does not often meet with nowadays; and we shall long mourn the absence of his genial presence, and his fund of anecdote and story. I am sure that, though many of you have your own sorrows and your own tragedies, your hearts will go out in sympathy to Lady Leigh, who, in the course of but a few months, has lost her husband and both her sons, who have been killed at the front. [Assent.] In the place of Sir Chandos Leigh, we have elected Lord Gorell of Brampton. He is, as I daresay you know, the son of a distinguished lawyer. He has already made a mark for himself; and, being a young man, he is naturally serving his country at the present moment; and, though we had hoped up to the last, as he was coming home shortly for a week's leave from the front, that he would be able to attend here to-day, I need not apologize for his absence, for it is one that you will think is both natural and proper. I am certain that, under happier conditions, we shall have the advantage of the abilities with which he is certainly endowed. Mr. Arthur Lucas, the Deputy-Chairman, is also an absentee to-day. I am sorry to say that he recently had to undergo a very severe operation. But I am glad to say his recovery has been most rapid. I am going myself to see him to-morrow; and I hope he will be back shortly to assist us with his ripe experience of the affairs of the Association. Colonel Le Roy-Lewis has been appointed an extra military attaché at Paris; and his intimate acquaintance with the French language, and his undoubted natural abilities, render him of most valuable assistance to his country. Mr. Palmer who, when I last addressed you, was a sergeant in the Royal Engineers, has now received his commission; but he is still busy on regimental work, and so unable to be here to-day.

THE ACCOUNTS TO JUNE, 1914—TECHNICALLY ILLEGAL DISTRIBUTIONS.

I will now turn to the question of the report and the balance-sheet which you have had circulated among you. I do not think I will waste your time very much on the question of this belated report. It is somewhat ancient history now, and has only an academic interest. But I should like to say a few words with reference to the balance-sheet which accompanies the report. I told you in November last year, as a justification for the distribution which I then proposed, that our monthly returns had shown that the business up to June 30 last year was quite as good as it was in the corresponding six months of 1913. I said nothing about our profits, because it was impossible to speak of them. Again last May, I proposed a further similar distribution. I then said we were earning fairly normal profits up to June, 1914; and, under normal circumstances, 4½ per cent. would have been paid as usual last November. We were almost certain it had been earned; and we have now information which makes it perfectly certain. However, we had no balance-sheet signed by the Auditor; and therefore I could not move for the usual dividend to be paid. Between June 30, 1914, and the time of the declaration of war, of course the accounts of some of our stations had already been received; and as is indicated by the fact that we have now prepared a regular balance-sheet and submitted the same to our Auditors, and it has been properly audited, we eventually received the fully vouched-for accounts from Berlin, Hanover, and our Bohemian stations, which had been previously missing. The decrease in the profit of £67,349 is fully accounted for by the increase of 1s. 10¾d. per ton in the cost of coal (which represents a sum of £46,000), and by the decrease in the value of coke and ammonia products. The net profit of £219,189, with the help of £3171 brought forward from the previous half year, justified the Directors in having made, and the proprietors in having accepted, the proposals for two distributions of 2¼ per cent. in November, 1914, and in May, 1915, respectively. After making these distributions, there remained a credit balance of £10,265. The reason why I wish to emphasize this point is that, although we proposed that this distribution should be made, without having a scheme prepared as provided by section 120 of the Companies' Clauses Consolidation Act, 1845, the balance-sheet proves that our action was one of intelligent anticipation, and that nothing has been distributed except profits—not only properly and fairly earned, but profits which were actually in our possession.

AN ILLEGALITY AND A BILL IN PARLIAMENT.

Well it seems that, however that might have been the case, these distributions were irregular, and not in conformity with the clause to which I have referred. The proper course would have been for you to have gone without these two dividends during last year, and have waited until to-day when, on the strength of the scheme which you have all had, we could have made a proper distribution of 4½ per cent. We thought, however, you would rather have your money at once, instead of waiting for this blessed day, and we could not really tell

when the day would come. We have undoubtedly committed an illegality of a strictly technical character; and we are advised by our legal counsellors that this can only be atoned for and washed out by an Act of Parliament. We intend to give notice of the promotion of a Bill in Parliament within a few days' time; and we shall take advantage of this to make clear and revise some of the clauses in our various Acts which are not sufficiently explicit. But, of course, no action in this matter will be taken by you to-day. You will all be called together in due course for the statutory or Wharncliffe meeting, when I shall have the pleasure of explaining to you at length the various clauses of the Bill. The measure is now receiving the anxious consideration of your Board. Now, of course, for the past two half years that have elapsed since the period with which the balance-sheet deals, we have no idea what profits have been earned; and, as I warned you on the last occasion, no further distribution can be made until after the war. Then we may be in possession of our own funds and moneys which are at present locked-up abroad.

THE PAYMENT OF FURTHER DIVIDENDS.

I daresay I may anticipate questions that will be asked me, and I think for many reasons it may be advisable if the shareholders were put in possession of some correspondence which took place between an eminent firm of stockbrokers and myself on this point. I think the letters bring out fairly clearly the position of affairs, and every proprietor ought to have the opportunity of reading them. The first is a letter from Messrs. Woolston and Co. to me, dated Oct. 4, 1915:

> We are interested on behalf of a large number of holders of the capital stock of your Company; and, though we are aware that the Chairman at the last meeting stated that it was not the intention of the Company to pay any further dividends until the end of the war, we have received so many inquiries that we hope the Board will see their way to reconsider the matter.
>
> The report shows that considerable reserves have been set aside in past years out of profits, which, in the ordinary course, would, we suppose, have been available for a dividend on the capital stock had not the Company wisely built-up reserves for equalization of dividends, &c., as shown by the balance-sheet.
>
> If it is possible to come to some arrangement whereby for the next two years a small dividend of (say) 3 per cent. could be paid to the stockholders, it would be a great help, and enable many small holders to tide over a difficult time.
>
> If any excuse is necessary for troubling you, it is that having for many years advised your Company's stock to investors, we know that the passing of the dividend would in many instances cause serious inconvenience.

["Hear, hear."] I quite understand your sympathy with that letter—sympathy which the Board fully share. I will now read you a copy of a letter that I wrote in reply dated Oct. 5 last:

> I am in due receipt of your letter of yesterday's date.
>
> The payment of a dividend would be illegal without a scheme showing profits, which it is impossible to prepare [see clause 120 Companies Clauses Consolidation Act, 1845].
>
> I would point out to you, as I have done to others, that since the war, with practically no receipts from abroad, we have paid away well over £300,000 in dividends, interest on debenture stock, and income-tax, payments which have seriously depleted our available cash resources.

I wish for a moment to refer to income-tax, because it is rather a serious item. I may say that, during the last week or two, we have been served with an assessment of the small sum of £100,000, which the authorities thought we ought to pay them. I need not tell you that we have appealed against such an assessment; and I hope and trust we shall get off altogether. [Continuing reading]

> I would also remind you that our principal assets are in the hands, and under the control, of the enemy; and, while this is the case, it would be impossible to say that our capital is intact, and therefore no distribution could be made from any "fund," even if we had the means to do so.
>
> In these circumstances, I hope you will think I was well advised in warning the shareholders not to expect further payments till the war was over.

Messrs. Woolston and Co. replied to me in a letter dated Oct. 6.

> We thank you for your letter received this morning, and for the information you so kindly give us with regard to Imperial Continental Gas.
>
> We are pleased to have this information, as it will enable us to explain the position in which the Company is placed more precisely when clients inquire as to the prospects of a dividend.

INFORMATION FROM THE STATIONS.

Well, I think I have dealt with that matter as fully as is necessary. Probably the proprietors would like to know something about what information we have with respect to those stations from which we are now cut off. But direct communication, as I have said, has been severed with our stations in Germany, Austria, and Belgium; but information of an interesting, and, I may say gladly, reassuring, nature has reached the Board by reason of the occasional visits paid by the Secretary to Holland, where he has met Messrs. Joerger and Körting, of Berlin. I will just tell you briefly what Mr. Körting recently reported. He says our coal supply continues to be very satisfactory. Coke is finding a ready market. Suitable arrangements have been made with regard to labour on the works; and we can look forward to the coming winter with some confidence. Then he shows how an ill-wind sometimes blows some good, by stating that the cutting-off of the supply of petroleum is having an extremely favourable effect on German lighting interests by residents taking gas and electricity. The gas consumption in July last was 4 per cent. higher than in July, 1914; and the consumption in August gave every indication of passing that of 1914. He then also told us what was very agreeable information for us to have, that his second in command, Mr. Thompson (who is an Englishman, and who was interned) had been released, and had resumed his duties on the works. I used the word "reassuring" with respect to this information, because it shows that at all events, up to the date of this information, our business was working in an absolutely normal manner, under the management of our own officers. Of course, our finances are strictly under the supervisors who have been appointed by the German Government. When we last heard as to our funds at Berlin, we considered them to be very considerable; and they looked as if they were still going to grow. But we shall not have the benefit of these until peace comes along. Berlin can safely be left to finance itself and the other stations under the control of the enemy. With regard to Belgium, there is nothing for me to say since our last meeting. In France, the town of Nancy, in which we have such considerable interests, has been visited, on more than one occasion, by bombs from German aircraft; but no damage of any considerable nature was done to any of our property. Our chief anxiety with respect to France has been the furnishing of coal to the Compagnie Continentale. But luckily the representatives of that Company have been able to draw upon the experience of Mr. Wilson in dealing with this complicated question. With freights from the North to Rouen at 21s. per ton, and coal costing 19s. per ton before it is handled at all, it runs us in to about £2 per ton at Rouen. But what it costs by the time it reaches Nancy, which is at the extreme east of France, I must leave to your own imagination. You may, however, be sure that Mr. Wilson and the London office are doing their best to assist our French *confrères* over their difficulties in this matter. I do not think I need trouble you any more with respect to these accounts.

Mr. H. Birchenough, C.M.G., formally seconded the motion.

Reasons for Confidence.

Sir Perceval Laurence said there were one or two observations which, with the indulgence of the meeting, he should like to be permitted to make. They would be of a general character, because the report and accounts, in the exceptional circumstances, did not suggest much in the way of either discussion or criticism. He thought the information was given at the last meeting (the Chairman would correct him if he was wrong) that the number of transfers of shares in the Association since the outbreak of hostilities had been very small. [The Chairman: That is so.] He was rather under the impression that the state of things in this respect had been similar since then. [The Chairman: Yes.] Now he thought there must be some cases (such as those hinted at in the letter from the stockbrokers which the Chairman had read) of executors and others where realizations might have been inevitable. But he could not help thinking that the general feeling of the proprietors was that the Association, owing to sound management in the past, still occupied a strong financial position; and so it would be a very great pity if any proprietors, who were not forced to do so, were induced by the anxieties and vicissitudes of the hour to sacrifice their holdings. [Hear, hear.] And he was fortified in this view by two considerations. Of course, the Association had been extremely unfortunate in the circumstances. He understood that practically all their property, their plant, and the sphere of their operations were either in enemy territory, or in territory which (he omitted some of the small places in France), since the early days of the war, had been in the occupation of the enemy. He daresay some of the proprietors had seen an article—an interesting, and it appeared to him to be a well-informed, article—which was headed "German War Legislation, as to Treatment of Enemy Property," and which appeared in the current number of the "Economist." He thought the proprietors would have some interest and satisfaction in reading the article. Now he understood, so far as the property of alien enemies resident abroad, and situated in the United Kingdom was concerned, that it was being administered by the Public Trustee. He believed, too, it was under the competent personal supervision of Sir William Plender. Similarly, under the ordinance of the German Federal Council, property of alien enemies in Germany was now under German control. He understood from the Chairman that, so far as Berlin was concerned, the control was merely of a financial, and not apparently of an administrative, character. He gathered there had been no disposition whatever on the part of the German authorities (he took it it was the same in Austria) to confiscate property. When the proprietors reflected that the amount, the bulk, and value of enemy property situated in the United Kingdom must far exceed the amount of British property situated in Germany, he did not think they need go very far to surmise the reasons for such forbearance. Passing from that to property situated in the countries of our Allies which at present were under the grip of the foe, this would not be the occasion, and it would be wholly imprudent, for him to attempt to weary the proprietors with anything like a discussion of what was known in his profession, and the Chairman's profession, as the law of comity. But he well understood that this cataclysm was not going to last for ever, and when they arrived at a tolerable issue, one of the essential and primary conditions of such issue would be compensation in respect of any damage which occupation by the enemy involved. If he was not wholly wrong with regard to these points, then there were reasons why they should not despond in regard to the future. These were reasons why all the proprietors of this important Association should endeavour to possess their souls in patience; and though it was impossible to forecast the future and anticipate the march of events, they might hope that the Association had before it a future no less satisfactory and no less creditable than had been the past.

Mr. Fyfield said he should like some information as to how it was that the prime cost of coal was so heavy, and the amount obtained for the bye-products had fallen off in such marked degree. Some explanation should also be given as to the loans to subsidiary companies. This showed a very heavy increase.

Mr. Bisgood asked whether the funds in Germany were on credit or in German war loan.

The Chairman said he could answer the last question. The latest information was that a certain amount of money both at Berlin and Hanover had been taken by the Government controllers, and invested in their war loan.

Mr. Bisgood: I take it, it is a large sum, Sir?

The Chairman said that it was not. It was about 3 million marks; and if they took 20 marks to the sovereign, it came to approximately £150,000, which was not a serious amount.

Mr. Bisgood: They will, I suppose, be able to meet their war loan?

The CHAIRMAN said he could not tell what the present situation was. The money was in the first two loans—not in the new loan.

Sir PERCEVAL LAURENCE said he saw Consols were put down at 80. Had they been converted into British war loan?

The CHAIRMAN replied that the Board had a grand debate on the question of the conversion of the Consols; but some of his colleagues were of one view, and some of another; and, like true Britons, they arrived at a compromise. Some of the Consols were converted; and some were not. The present position was that they had £300,000 out of £500,000 of Consols unconverted.

The motion was unanimously carried.

SALE OF THE FRANKFORT SHARES—A BIG TRANSACTION.

The CHAIRMAN: Now, Ladies and Gentlemen, I wish to separately address you, and make a motion with reference to Frankfort. This time last year, curiously enough, I forgot to mention Frankfort; and it was only at the close of the meeting that a proprietor came up, nnd drew my attention to the fact. On this occasion, I think Frankfort must loom rather largely in my remarks. The history of how the Association became the predominant partner in the Frankfort Gas Company was told to the proprietors by Mr. Palmer, my predecessor in the chair, in November, 1909. He told the proprietors then how, in order to save the interests of the Association, the capital of the Frankfort Gas Company was enlarged to embrace the station and undertaking of the Association, and to enable the Corporation to become partners in the Gas Company by subscribing for a large block of shares. In the Frankfort Gas Company, we held the controlling interest, and nominated a majority of the Board. At the outbreak of war, the Association held 7705 shares out of 13,600 shares. The Corporation owned 3157 shares, and the general public 2758 shares. An important condition of the new contract made between the Corporation and the Company was that the Corporation should have the right, under certain specified terms, to purchase the whole of the concern on Oct. 1, 1929. Now bearing this in mind, I want to tell you that the Company working in the way that it did, was a most successful company and regularly paid dividends of 10 per cent. In February last, the Board received a communication to the effect that the Frankfort Corporation wished to buy the whole of the shares of the Association at the price of 1700 marks—that was to say, £85 (I am treating the pound as being worth 20 marks)—for each share of £50 nominal. And with this we were to receive the usual dividend of 10 per cent. for the year ending April, 1915. The proposal was considered by the Board; and we thought it right to send, in reply, a resolution to the effect that the Board were absolutely precluded by legislation from entertaining the proposal. The next month—March—the Secretary received permission from the Foreign Office to go to Amsterdam to meet our representatives from Berlin. At this conference, which took place between the Secretary and these gentlemen, the sale of the Association's Frankfort shares was again raised. On his return, the Secretary submitted to us a report on the question; and, in consequence of this report, the Board came to the conclusion that it would be desirable to sell in the interests of the Association. We sent a copy of the Secretary's report and of the resolution of the Board to the Foreign Office; and they referred the whole question to Sir Arthur Thring, the Parliamentary Counsel. We then received from Sir Arthur permission to negotiate with the town authorities of Frankfort on terms laid down by him. In June, Mr. Wilson again proceeded to Amsterdam; and the final result was an agreement between the Corporation of Frankfort and the Association, by its representatives in Germany, which has received the sanction of the Parliamentary Counsel. I do not think I can do better than read to you the principal correspondence with respect to this, which will explain everything.

After doing so, the Chairman resumed his speech: From it you will see that, for the 7705 shares, the Association is to receive a price of £99 per share, without taking exchange into consideration, or £762,795. But this sum includes the agreed amount of £11,887 compensation to the Directors for loss of office. Secondly, the dividend for the year 1915, amounting to £38,525; and the balance of the loan £140,000, so that altogether, at the conclusion of peace—taking again as I warned you (because I am not going to make any prophecy) the value of the mark as 20 to the pound—there will be a total sum to be paid to us of £941,320, *plus* interest on the purchase-price of the shares, and of the balance of the loan. I may remark that the value of the shares on the books of the Association stands at £460,650 5s. 6d.

PIONEERS OF GAS SUPPLY IN GERMANY.

I have, in thus treating of the history of the Frankfort Gas Company to remind you that a very long, and, I may say, most agreeable connection hitherto, comes to an end. I dare say those of you who are acquainted with the history of the Association will remember we were the pioneers of the gas industry in Germany; we were the first that ever burst upon that scene. We began at Hanover in 1825; and we went to Berlin in 1826. Our connection with Frankfort is as old as 1829.

GOOD RELATIONS AND GOOD-BYE.

I do not think I ought to sit down without referring in some way to the relations that had existed up to the very end with our late colleagues of the Frankfort Board; and I must in that regard just trouble you for one moment more by reading a short extract from the speech of Mr. Scharff, the Chairman of the Company, at a meeting held on Sept. 10 last. He said:

> In an old song, the passage occurs: "When friends part, they say *au revoir*." In this case, this does not apply. We shall never see these gentlemen, with whom we got on so well, among us again. I find it to a certain extent difficult, in view of the war which we are now waging with England, to say a good word for an Englishman; but in this case I make an exception. These gentlemen have never done us any harm, They have always been pleasant to us; and they have achieved much in the sphere of the gas industry. Although the German gas industry is at present quite up to date, it must nevertheless be recognized that

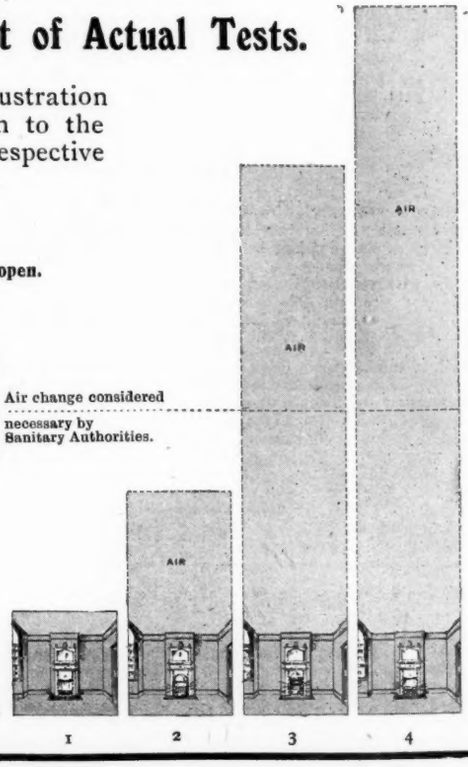
VENTILATION.

Interesting Comparison—the Result of Actual Tests.

The heights of the columns in the accompanying illustration show the comparative volumes of air (in proportion to the size of room) which are carried off by means of the respective heating agencies.

1. **Room to be heated.**
2. **Air-change with ordinary gas fire.**
3. **Air-Change with "Injector-Ventilating" Gas Fire, with regulator open.**
4. **Air-change with coal fire—excess tending to draught.**

It will be seen how the amount of ventilation provided by the "Injector-Ventilating" Fires is substantially above the figure regarded as a suitable minimum by Sanitary Authorities generally. **This figure is indicated by the dotted line crossing the diagram.**



NO NEW DESIGNS *are necessitated for embodying this and our other 1915 perfectionments—these are all included in the entire range of our existing standard patterns, from the cheap 10-in. Fire of 25s. List price upwards.*

John Wright & Co. Essex Works, **Birmingham.**

gas is used far more in England than here; and it is just in this respect that these gentlemen always gave us such good advice. I would also remind you of the satisfactory condition of the Bockenheim works, and of the erection of the successful new works at the Osthafen, in which all the gentlemen took a lively interest. You will doubtless join with me in wishing them a hearty farewell, and in thanking them for all they have done for the gas industry in Frankfort. Owing to existing circumstances, I am not at present in a position to express our thanks to these gentlemen—perhaps Mr. Joerger will be able to do so.

I have read these remarks *in extenso*, because I should like to say, on behalf of myself and my colleagues of the Frankfort Board, that I very heartily reciprocate the feelings which prompted Mr. Scharff to make them. We had nothing but kindness and courtesy from the members of the Frankfort Board; and, whatever we may think of the Germans and German doings, I can say candidly "Good-bye" to those former colleagues. You have heard now all I have to say of Frankfort; and therefore, in order to put all I have said into order, I wish to ask for your formal approval of what the Board have done in disposing of these shares. I will move—"That the action of the Board of Directors in concluding a contract with the Municipality of Frankfort-on-Main for the sale of the 7705 shares held by the Association in the Frankfort Gas Company be, and is hereby, approved."

Mr. BIRCHENOUGH, in seconding the motion, said: I think the transaction, as set out by the Chairman, can be recommended for your approval as a satisfactory one.

The motion was unanimously carried.

CHELTENHAM GAS-WORKERS' DISPUTE.

Award in the Men's Favour.

It is understood that Mr. Warrender Mackenzie, K.C., the Arbitrator appointed by the Board of Trade to adjust the difference between the Cheltenham Gas Company and their employees on the question of a war bonus [*ante*, p. 330], has issued his award, and that it is favourable to the men's demands, though they do not receive quite all they asked for.

It will be remembered the men applied for a war bonus of 3s. 6d. per week, on account of the increased prices of commodities. The Arbitrator has awarded them 3s. per week, or 6d. less than they asked for. The increment to the wages will date as and from the first full pay week after Oct. 9, and will continue until the termination of the war and the declaration of peace, after which wages will revert to the normal standard.

As already stated, the Arbitrator was not to decide the question of the recognition of the men's Union. This matter remains to be adjusted between the Company and their employees.

WARRINGTON CORPORATION GAS UNDERTAKING.

Application for a Calorific Standard to be Substituted for Illuminating Power.

At the Warrington Town Hall, on Wednesday last, Mr. A. W. BRIGHTMORE, D.Sc., M.Inst.C.E., an Inspector of the Local Government Board, held an inquiry relating to the application of the Corporation for the issue of a Provisional Order under sections 297 and 303 of the Public Health Act, 1875, to partially repeal, alter, or amend the Warrington Corporation Gas Act, 1877, so as: (1) To provide for the abolition of the standard of illuminating power of gas supplied; and the substitution therefor of a calorific standard; (2) to increase the pressure at which gas is required by the Local Act to be supplied by the Corporation; (3) for the several purposes of the application, or for purposes connected with, incidental to, or consequent upon, those purposes, to make any alterations or amendments of the Local Act as may be necessary or desirable.

STATISTICAL INFORMATION.

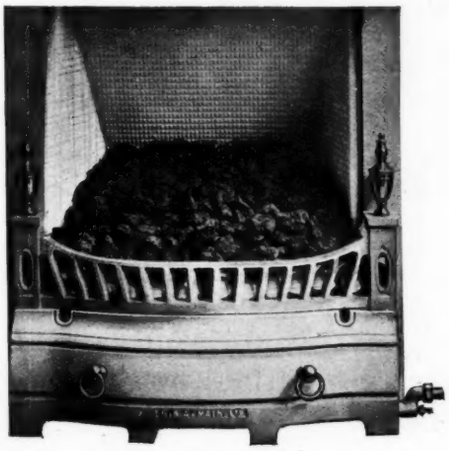
The DEPUTY TOWN CLERK (Mr. A. T. Hallaway) said that at the census of 1911 the population of the County Borough of Warrington was 72,178; and the estimated population to-day was 76,000. In 1901 it was 64,242; and at the census of the previous decade, 52,742. The area of the borough was now 3116 acres; and the rateable value of the town to the borough rate was £308,979. The assessable value of the borough to the Improvement Committee was £286,643. The rates in the town were 9s. 4d. in the pound; last year they were 8s.

Regarding the gas undertaking, the information supplied to the Inspector was as given on p. 394.

THE PURPOSE OF THE APPLICATION.

The DEPUTY-TOWN CLERK said the application, as set out in the public notice, was to provide for the abolition of the standard of illuminating power, and also to increase the pressure at which gas was required to be supplied. With regard to the second portion of the application—increasing the pressure of gas—the Corporation did not propose to proceed with this at the present inquiry. It was not covered by the resolution that was passed by the Corporation, and was inserted in the Draft Provisional Order rather under a misapprehension. This had given rise, he had been informed, to the people in their area of supply thinking that the idea, and the result, would be that the Corporation would force the gas through the meters at a much quicker rate; and that certainly they would pay more. He (the speaker) very much regretted that an impression like this should have got abroad. In the Act of 1877 was a clause which was ample for the requirements of the district; and they would accordingly drop the proposal to increase the pressure. When the Warrington Corporation

THE MAIN GAS FIRES.



The ST. NICHOLAS.

The St. Nicholas—

The Gas Fire without a rival.

The new booklet—"Main Reflections"—contains particulars of several new Gas Fires. Copies free on application.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

GAS UNDERTAKING.—*Statement of Debt, 31st October, 1915.*

Purpose.	Authority.	Amount Sanctioned.	Date of Sanction.	Original Period.	Equated Period.	Amount Borrowed.	Amount Repaid.	Amount Outstanding.
		£ s. d.		Years.	Years.	£	£	£
Purchase of gas undertaking .	Warrington Corporation Gas Act of 1877	176,764 0 0	—	75	56	176,764	66,487	110,276*
Extension . .	Do.	52,350 0 0	—	50	29	52,350	34,826	17,524
Do.	Act of 1879	18,000 0 0	Feb. 16, 1893	24	29	17,481	9,515	7,967
Slot meters . .	Provisional Order, 1896	4,750 0 0	June 17, 1898	10	29	2,064	2,064	—
Extension. . .	Acts 1877 and 1879.	2,000 0 0	Oct. 2, 1895	10	29	2,000	2,000	—
Land	Act of 1911	2,083 16 6	—	48	—	2,084	89	1,995
		255,947 16 6	—	—	—	252,743	114,981	137,762

* Includes annuities of £2531 outstanding, at thirty years' purchase—£75,933.

purchased the undertaking of the then local Gas Company, in 1877, the standard of illuminating power was 16 sperm candles; and there was the usual clause in vogue at those times relating to the question, and Sugg's "London" argand No. 1 was the test-burner employed. But since 1877 there had been very great changes in the usage of gas. At that time gas was largely (if not wholly) consumed for illuminating purposes; and at that time, undoubtedly, the illuminating standard was a proper one. Since then, however, circumstances had greatly changed. To-day they found that the use of gas in commercial businesses had very largely increased—in fact, it equalled, if it did not exceed, the use of gas for illuminating purposes. Warrington he (the Deputy-Town Clerk) emphasized was a town where there were a great number of industries. [Warrington claims to have more industries in its area than any other borough in the United Kingdom—including, as it does, gas-apparatus manufacturers, wire-works establishments, soap-making concerns, india-rubber trades, chemical research organizations, and other up-to-date traders]. In 1877, illumination was practically confined to what were known as flat-flame burners. To-day (except in isolated cases) these burners were quite a thing of the past. When he said "isolated cases" he meant that they might, perhaps, be found in cellars or in lavatories, and other such places where a greater illuminating power was not necessary. For the purpose of giving light, the flat-flame burner was non-existent. Consumers had changed to incandescent mantle burners. As the Inspector would doubtless be aware [Mr. Hallaway proceeded], for the production of light by the incandescent mantle it was unnecessary that there should be any illuminating power in the gas at all. The lighting to-day was produced by the calorific power of the gas, upon the mantle, producing incandescence. Incandescent gas lighting was the modern lighting; and there was no necessity at all for 16-candle power gas in Warrington.

COMMERCIAL USES OF GAS.

Similarly with regard to the commercial use of gas; in this case it was required for heating purposes. It was immaterial to the commercial user whether the candle-power was 20, 10, or 5. In 1914, this principle was generally recognized by Parliament; and also (as the Inspector would remember) in the Bill of that year promoted by the Gas Light and Coke Company. It formed a precedent for a great number of other Bills that session. One he remembered particularly was that of the Liverpool Gas Company. The question was fought out in the House of Commons at very great length; but Parliament, once and for all, definitely decided that the old-fashioned candle-power test was entirely obsolete and unfitted to modern requirements. It placed too great a burden on the manufacture of gas. The Corporation of Warrington had considered this matter for some time; and they had now come to the conclusion that, owing to the increased price of the materials necessary for enriching the gas in order to keep up to the illuminating power standard—an altogether useless standard, if he might say so—it was no longer necessary. The Gas Engineer to the Corporation (Mr. W. S. Haddock) would be called to give evidence in support of the application, and would tell what coal and cannel had been used during the last six years, and the average illuminating power for these years. The time had now come when the Warrington Gas Committee thought it was necessary to approach the Local Government Board to alter their obsolete Act. The proposed new standard would not only be of benefit to the gas manufacturer, but it would be to the benefit of the consumer. The Corporation were, of course, not a philanthropic institution; they found it to their interests to reduce the price of gas as much as possible.

INCREASED DEMAND FOLLOWS A REDUCTION IN PRICE.

They found that an increased demand for gas invariably followed a

Is your Showroom the powerful Gas-selling force it ought to be?

If not, let The Nautilus Co., Ltd. (the only Specialists in Gas Showroom Art), show you how it can be made so. No fees charged for Advice, Plans, Specifications or Estimates.

N.B.—Several important Gas Undertakings have already adopted Nautilus Showroom Schemes.

The Nautilus Co., Ltd.
(Proprs.: The Davis Gas Stove Co., Ltd.),
60, Oxford St., London, W.

reduction in price. When the Corporation took over the old Warrington Gas Company's works in 1877, gas was sold at 4s. per 1000 cubic feet; and previous to the general rise by Lancashire gas undertakings they were able to supply at 2s. 1d. net. But, owing to the increased price of materials, and the decreased revenue from residuals, they found it necessary (in common with other gas manufacturers throughout the kingdom) to increase the price of gas—temporarily, he hoped. After reiterating the point that the substitution of the calorific standard for that of the illuminating power standard would be of benefit to the consumers, the speaker concluded by asking the Chairman of the Stockton Heath Council, and the representative of the Runcorn Rural Council, whether they were present to oppose the scheme.

After a conversational discussion between the Inspector and the Deputy-Town Clerk regarding the original proposals of the Gas Light and Coke Company as to the standard calorific test, and also a statement that the Northwich Gas Bill of last session fixed the standard at 500 B.Th.U., with a 7½ per cent. penalty clause, and so on, according to deficiency in relation to test,

Mr. M'INTYRE (Stockton Heath) said he had no instructions from his Council to oppose the application, neither did he see the necessity or wisdom of doing so.

THE GAS ENGINEER'S EVIDENCE.

Mr. *W. S. Haddock* said he had been Gas Engineer to the Corporation of Warrington for the last 27 years. He had prepared a table showing the average illuminating power, the cubic feet of gas made, and the coal and the cannel used during the last six years, from which it would be seen that the gas made showed a steady increase. On the acquirement by the Corporation of the old Gas Company's undertaking the price of gas was fixed at 3s. 6d. per 1000 cubic feet; from 1903 to 1906 it was 2s. 6d.; 1907 to 1908, 2s. 2d.; and 1909 to 1915, 2s. 1d. The price was now—owing to the increased price of materials on account of the war—2s. 6d. per 1000 cubic feet net. In order to keep up the standard of 16-candle power prescribed by their Act of 1877, they had had to use considerable quantities of benzol every year. The following figures showed the main statistics:—

Year.	Average Illuminating Power for the Year.	Coal and Cannel Used (Tons).	Gas Made (Cubic Feet).
1915 . . .	16·11 ..	55,463 ..	561,697,000
1914 . . .	16·34 ..	51,523 ..	549,553,000
1913 . . .	16·49 ..	48,119 ..	515,306,000
1912 . . .	16·86 ..	45,566 ..	483,991,000
1911 . . .	17·73 ..	42,874 ..	462,662,000
1910 . . .	17·87 ..	41,054 ..	447,211,000

The DEPUTY TOWN CLERK (to Mr. Haddock): You have had to incur considerable expense in your department in order to keep up to the statutory power?

Witness: Yes; we have had great expense in enrichment; commodities have become so expensive that it is almost impossible to get hold of them at the present time.

Is it not reasonable for me to suggest that if you had not such a high standard for your illuminating power, the natural corollary would be that gas could be still cheaper?—Yes.

Therefore this clause that you suggest is not only in the interests of the large manufacturers in the town who use gas, but in the interests of the small consumers?—Undoubtedly.

Have you any reason to suppose that any injustice will be done to the gas consumers as a whole by the substitution of a calorific standard for the illuminating power standard?—No. I expect it will be very beneficial to the gas consumers as a whole, as also to the commercial users of gas.

Do you consider that 500 B.Th.U. is a reasonable test to ask for, and that the interests of all the consumers will be amply safeguarded by the proposed test?—I believe so.

The INSPECTOR having asked a question relative to the 500 B.Th.U. standard,

Mr. *Haddock* said this was only a precautionary measure. The calorific standard might go lower when old stocks of coal were being used in times of stress—such as strikes, &c. It was only in abnormal times that the standard might be reduced. Coal deteriorated through being kept in stock.

The DEPUTY-TOWN CLERK observed that during the last coal strike the Liverpool Gas Company reduced their gas to 19-candle power, and no one was the wiser. They (Warrington) only desired a margin. They did not propose to regard the standard of 500 B.Th.U. as a maximum. The penalty clause was inserted so that they should not be excessively penalized in times of great stress when no man could carry out his obligations.

The DEPUTY TOWN CLERK (to Mr. Haddock): In general, the gas will be supplied of greater calorific value than 500 B.Th.U.

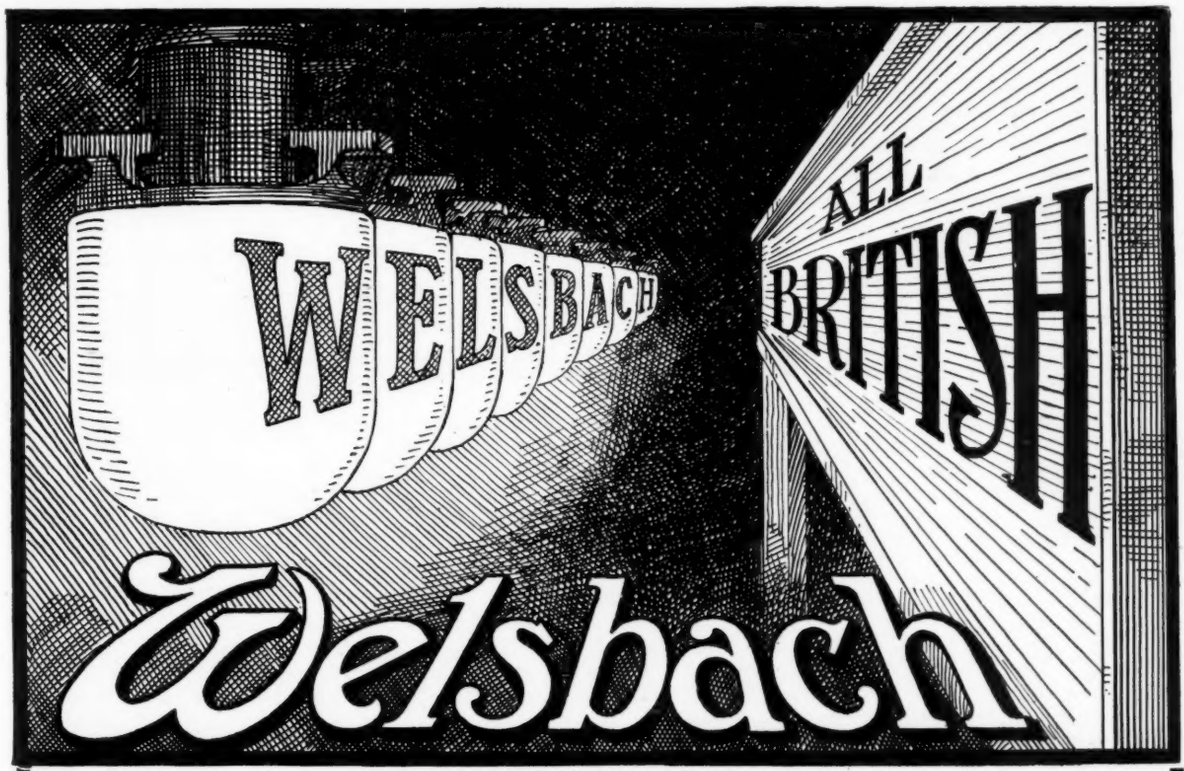
Witness: Yes. I have not heard of any opposition to the proposals.

The INSPECTOR: Can you give me any idea of what saving will be effected by the alteration of the standard?—Do you mean in the cost per 1000 cubic feet, or the cost per annum? There would be a large saving in the cost of cannel, for which we pay higher prices than for ordinary coal. The saving would be the difference of the price of cannel and the price of ordinary coal—something like (from memory) about 7s. or 8s. a ton on what we are at present using. It had, witness said, for many years past been conceded that gas of a uniform calorific standard was more satisfactory for all ordinary purposes. This was shown by the fact that a large number of gas undertakings had adopted the calorific standard.

The INSPECTOR asked for an abstract of the gas accounts, showing the cost of manufacture, &c., and received an assurance that these would be forwarded in due course.

EX-CHAIRMAN'S TESTIMONY.

Alderman *John Evans*, ex-Chairman of the Gas Committee, said the proposals outlined were in the interests of the borough. The Gas



Write for Particulars and Samples.

THE WELSBACH LIGHT COMPANY, LTD.,
WELSBACH HOUSE, KING'S CROSS, LONDON, W.C.
AND AT BIRMINGHAM, MANCHESTER, LEEDS, STOKE-ON-TRENT, HULL, BRISTOL, AND DUBLIN.

Welsbach Mantles are Upright (C, CX, and Plaissetty) and Inverted.

Committee, before presenting their proposals to the Town Council, very carefully considered all aspects of the question. The more cannel they used for the making of gas, the less benzol they needed; the saving would be in the cost of the benzol and the difference in price between coal and the cannel.

The INSPECTOR: Would it save benzol entirely.

Mr. *Haddock:* Yes.

The INSPECTOR: Have you any idea, on present prices, as to what would be the saving per year?

The DEPUTY TOWN CLERK replied that he thought the amount would be, roughly, about £4000 to £5000.

Mr. *Haddock:* No; not that much. It might be somewhere between £2000 and £3000. The increased cost of labour, he added, might absorb a good proportion of the amount named.

The inquiry concluded without opposition.

BIRMINGHAM CORPORATION'S ARRANGEMENT FOR INDISPENSABLE MEN.

Last Friday a conference took place at the Birmingham Council House between representatives of the Gas, Water, and Electric Supply Committees with reference to the recruiting of men engaged by the respective departments—including the repair gang working on the water-mains between Birmingham and Wales. The question was discussed as to the steps to be taken to bring to the notice of the men the resolution adopted by the Council at their recent meeting—that those men who have war-service badges shall be treated, if taken by compulsion, as though they had voluntarily offered their services, under the resolution of the Council passed in September last.

It was decided that a notice should be posted in the various works concerned, to the effect that men with badges must not enlist, as they were as useful in their present capacities as they would be in the army. With regard to the unstarred men, they are to be allowed to enlist if they wish under Lord Derby's scheme, the general effect of which is that they are attested and return to their ordinary employment until called up. At the time they are called up, the employers may apply to the local tribunal to have them put in a later group.

Tees Valley Water Board.—At a meeting of the Tees Valley Water Board, held at Middlesbrough last week, a statement was presented respecting the annual charges on rates for the boroughs of Middlesbrough and Stockton and the district of Thornaby. For Middlesbrough, the charge for the year ended March 31 was £1618; for Stockton, £4446; and for Thornaby, £1163. The annual charges on the Corporations up to March 31 for interest, redemptions, and sundries were for Middlesbrough, £55,618; for Stockton, £49,446; for Thornaby, £10,163.

THE WOODALL-DUCKHAM RETORT INSTALLATION AT WORKINGTON.

The installation of Alderman Patrick Walls as Mayor of Workington gave him the opportunity of referring to the vertical retorts on the Woodall-Duckham system that were recently started in the town.

He said that, so far as local matters were concerned, the past year had been somewhat uneventful. But they had just completed what was, perhaps, the best and most up-to-date gas plant of its size in Great Britain. Their Gas Engineer (Mr. Horace Chamberlain) and the Chairman and members of the Gas Committee deserved the best thanks, not only of the Council, but of the citizens of Workington. The Chairman had devoted as much time and thought to the work as he (the Mayor) had ever known a man to devote to anything that was solely for the public good. They were fortunate to have the contract placed, and most of the work carried out, before war prices prevailed. If they had not taken action in the matter at the time they did, it would have had to stand over for years, whatever the consequences might have been.

Subsequently a letter written by Alderman Hall (who had proposed the election of the Mayor) was read to the Council, to this effect: "I have pleasure in informing you that in the twenty-four hours from six o'clock Monday morning to six o'clock this morning, the new carbonizing plant has produced without any special effort half-a-million cubic feet of gas from eight retorts. If you take into consideration that this plant only commenced making gas on the 4th of October, the record is unique in the production of gas in this country."

Gas Poisoning Fatalities.—Two inquiries were held by the Bradford City Coroner on Monday of last week into deaths from gas poisoning. One was a case of suicide, and the other of misadventure; the latter arising from a split in a gas-pipe, which caused the death of a widow during the night. At Swansea, also, a domestic servant was found in bed suffering from gas poisoning, to the effects of which she succumbed.

The New Carbonization Methods at Darwen.—Speaking at Darwen on Mayor's Day, Alderman John Tomlinson (who was previously Chief Magistrate in 1900-1-2) referred to the necessity of curtailing municipal expenditure. With regard to the new installation of retorts on the Munich chamber system, he said that no doubt it was due to the internment of the German erectors that a slight amendment in the plant became necessary. This, however, had been done at the cost of the Contractors. It was early to say that everything was now entirely satisfactory, or that the full benefits would accrue in the present financial year. He expected, however, that the following year their highest expectations would be realized. The Gas Engineer (Mr. A. H. Smith) supported him in this view.

Of High Repute!

The Mediterranean Expeditionary Force Hospitals

have installed Richmond's Gasfires, owing to their reputation as—

The SILENT Gasfires.

The Lancet says:—"We have had one of Richmond's Silent Fires under observation in a bedroom for several days, and the result is very satisfactory. . . . . It seemed incredible that gas was being consumed at the rate of about 30 feet an hour in a cheery red fire giving a genial warmth and comfortable aspect to the room."

THE RICHMOND
GAS STOVE & METER CO., LTD.,
London and Warrington.

The Reputation is well founded!

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

On Thursday the Glasgow Town Council met to receive reports from no less than twenty-seven different committees. The Gas Committee, in their minutes, stated that the Town Clerk had sent to the various colliery owners and coal merchants with whom the Corporation had made contracts for the supply of coal for the year ending June 30 next, giving notice in terms of the Price of Coal (Limitation) Act, 1915, that the coal under such contracts was excepted coal, and that the Corporation proposed to claim the benefits they were entitled to under the Act. Sir John Lindsay reported the replies which had been received, and submitted the opinion of Counsel to the effect that the comparison of prices to be made under the Act should be made with the sale prices of yearly contracts, not isolated sales, in the year ended June 30 last, and that, as the only sales of coal for delivery in comparable quantities over twelve months, which took place in that year, were those made by the Corporation in May or June, these last-mentioned sales, in the opinion of Counsel, were the only sales with which comparison in terms of the Statute fell to be made. It was remitted to Bailie Irwin, Bailie Drummond, and Councillor P. G. Stewart to take whatever action they might consider advisable in the interests of the Corporation, to settle any questions as to prices arising under the Act in relation to deliveries of coal from and after the 29th ult., under contracts for coal for the Gas Department for the year to June 30 next.

At a meeting of the Perth Town Council this week, there was some discussion with regard to a minute of the Gas Committee, which set forth that it had been unanimously resolved that the present was an inopportune time for giving an increase of wages to employees at the gas-works. Ex-Bailie Macpherson, in moving adoption of the minute, said there were thousands of people in this country who suffered in income in consequence of the war, and had to pay the increased cost of living, and who had no employers to go to. The agent of the men's Union had stated that if the increase was not granted they would appeal to the Minister of Munitions. He understood they were taking this step; and he thought the Town Council would be justified in holding their hand until they saw what the Minister of Munitions said about the demand. Mr. Bruce moved that the question be remitted back to the Committee for their favourable consideration. Treasurer Clark said the discussion should not have been allowed, as the Council had decided that no increases were to be granted. Bailie Beaton suggested that the speaker should be permitted to state his argument; but when Mr. Bruce resumed his speech many of the members left the Council Chamber. Ultimately the Council adjourned.

At a meeting of the Kirkcaldy Town Council on Monday, the question of the threatened strike of the gas-workers was under consideration. It was agreed, on the recommendation of the Emergency Committee, to grant an increase of wages; the employees being found to be underpaid, as compared with similar workers elsewhere.

On Wednesday evening, Mr. Alex. Yuill, the Manager of the Dundee Gas-Works, delivered a lecture entitled "Our Gas-Works"—one of a course of lectures organized by the Dundee Educational Committee. In the course of an interesting and instructing talk, Mr. Yuill dealt with the history and physics of gas as an illuminant. He touched upon the multifarious uses to which gas is now put—including the manufacturing of munitions of war. In Dundee in 1900 the make of gas was 622 million cubic feet, whereas in 1915 it had risen to 1137 millions. The coal used, and equivalent of oil, was 105,000 tons; the coke and breeze produced 59,000 tons; the tar made, about 6000 tons; and the sulphate of ammonia produced, 1200 tons. The number of men on the staff is 386; and the number enlisted to date 120. Mr. Yuill, by demonstration and experiments, showed the growth of gas as an illuminant from its earliest stages, as also demonstrating the combustion of gases. Lantern slides of the Dundee Gas-Works were shown; and at the close the lecturer was accorded a hearty vote of thanks.

Women gas-meter inspectors are being appointed in Glasgow. The examination they have to pass before entering the service is described as a "fairly stiff" one. Quite a number of candidates have qualified, and are now making a beginning at meter work.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 15.

There is no point of interest in the tar products market, values generally being unchanged.

Sulphate of ammonia continues to be in a strong position; the prompt price being £15 7s. 6d. to £15 10s. net per ton, filled into buyers' bags at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Nov. 15.

There is little alteration in the markets for tar products. Pitch is still very weak, and lower prices have been accepted at some ports. Fair quantities of creosote are offering at reasonable prices. Solvent and heavy naphthas are in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 19s. 6d. to 23s. 6d. Pitch, East Coast, 18s. to 19s. per ton; Norfolk, Suffolk, and Humber ports, 18s.; West Coast, 16s. to 17s. Manchester;* 17s. to 18s. Liverpool; 19s. to 20s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d.

* Owing to a clerical error, the price of pitch last week was inserted as 17s. to 18s., whereas it should have been 16s. 6d.—a price at which a fair quantity was sold.

Kindly forward us YOUR enquiry to-day.

R. & J. DEMPSTER, Ltd., MANCHESTER.

London Office:
165, GRESHAM HOUSE,
Old Broad St., E.C.

Solvent naphtha, naked, North, 1s. 11d. to 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅞d. to 2⅞d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 6d. Naphthalene, £18 to £28; salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Nov.* 13.

During the past week the tone of the market for this article has remained very strong, and a further substantial rise in prices has taken place. Demand has continued on a big scale, but supplies have been rather limited, and consequently the amount of actual business concluded has been restricted. The closing quotations were £15 15s. per ton f.o.b. Hull, £16 f.o.b. Liverpool, and £16 2s. 6d. f.o.b. Leith. In the forward position, makers have now assumed a very conservative attitude, though first-hand sales have been reported at £16 per ton for January-June, and at £16 5s. for January-March, f.o.b. good ports.

Nitrate of Soda.

This market has continued steady throughout the week, and spot prices are unaltered at 14s. 4½d. per cwt. for ordinary quality and 15s. 4½d. for refined.

Sulphate of Ammonia.

From another source it is stated that the market for this article has remained firm throughout the past week. Outside London, makes are quoted at £14 12s. 6d. to £14 15s.; Hull, £15 12s. 6d. to £15 15s.; Liverpool, £15 15s.; Leith, £15 17s. 6d.; Middlesbrough, £15 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is generally steady; and while for prompt delivery the supplies are barely adequate, the fluctuations in the arrivals of steamers might soon affect this, though the difficulty in obtaining the export licences is now much lessened. The collieries, however, have tonnage booked in most cases for this month. The steam coal market is moderately active, and thus the range of prices is sustained. Best Northumbrian steams are quoted from 19s. 6d. to 19s. 9d. per ton f.o.b.; second-class steams are 16s. 6d. to 17s. per ton; and steam smalls are in good supply at 10s. 6d. to 13s. per ton. Forward quotations are more irregular; but it is expected that a Government demand will give some amount of briskness to the steam coal trade. The gas coal trade is active, and a good inquiry for Durham coal generally is experienced. Best Durham gas coal is 19s. 6d. per ton f.o.b.; second-class gas coal is from 16s. 6d. to 17s. 3d. per ton; and for "Wear Specials," there is a steady quotation of about 20s. per ton. The output of gas coal is good when the limitation of miners at the collieries through enlistment is borne in mind. Long-contract quantities of gas coals take up much of this output, and the foreign shipments are fair, especially for France. The cost of sea carriage is higher—as much as 13s. has been quoted from the Tyne to London, and about 21s. to Rouen, but running contracts are at lower rates. An inquiry is in the market for 30,000 tons of Durham gas coal for Denmark for next spring shipment, which may test the forward prices. Coke is rather dearer for some kinds. Good gas coke is quoted from 27s. 6d. to 29s. 6d. per ton f.o.b. in the Tyne. There is a larger make now, and stocks at some of the inland works are slightly larger.

Nottingham Gas Undertaking.—Mr. W. Gatb, one of the Nottingham City Auditors, in his annual report as to the gas undertaking, states that the surplus assets are equal to 49·73 per cent. of the capital expenditure, or, in other words, that nearly 50 per cent. of the undertaking belongs to the Corporation. The remainder is represented by the holders of annuities and other stock.

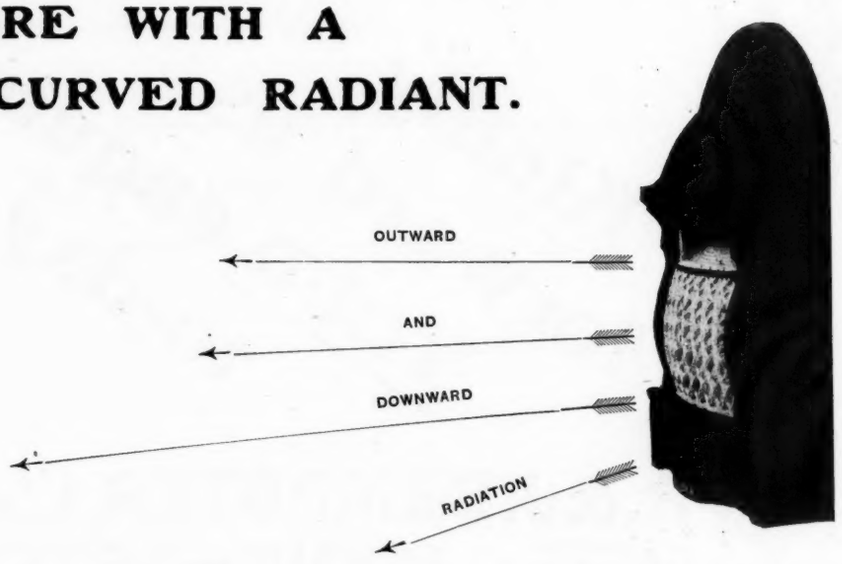
Birmingham Committee Chairmanships.—Alderman Sir Hallewell Rogers has been re-elected Chairman of the Gas Committee of the Birmingham City Council, and Alderman J. H. Lloyd has been re-appointed Chairman of the Water Committee. As both have been Chairmen of their respective Committees for more than three years, their appointment for the ensuing year will, in accordance with the Standing Orders, have to be confirmed by the City Council.

Public Lighting of Manchester.—The Manchester Watch Committee, last Thursday, in response to the wishes of the public, decided to ask the Home Secretary to remove the lighting restrictions in the city. The question had been raised on many occasions by various public bodies, by Coroners' jurors, and by the Gas Committee of the Corporation; Alderman Ashton bringing the matter before the latter Committee. At the meeting of the Watch Committee alluded to, it was agreed—"That the Town Clerk be instructed to make suitable representations to the Home Office, with a view to the Order as to the lighting of the City of Manchester, issued by the Home Office on April 8, 1915, being withdrawn."

Quality of the Gas at Burton.—Referring to the fact that many complaints regarding the quality of the gas have lately been received, Alderman Lowe, in submitting the report of the Gas and Electricity Committee at the last meeting of the Burton-on-Trent Town Council, explained that the special requirements of the present time necessitated the putting into operation of processes which had a deleterious effect on the illuminating power of the gas, though they were doing all they could to save the public from inconvenience. A letter had been received from the authorities giving the assurance that, should they fail to supply gas of the quality required by their Act, they would be indemnified against any claim that might be brought by consumers in the town.

An Obvious Advance.

A FIRE WITH A CURVED RADIANT.



A Maximum of PURE RADIANT HEAT.

The "LANCET" says "This fire showed no escape of combustion products into the room whatever."

The "LANCET," June 12th, 1915.

MANUFACTURERS:

THE VULCAN STOVE CO., Ltd. **EXETER.**

Portsmouth Water Company.

Special interest will attach to the half-yearly meeting of the Borough of Portsmouth Water-Works Company on Thursday, in view of a notice of motion regarding the payment of back-dividends which has been given by Colonel Ford, V.D. The Directors report that the available balance on the profit and loss account is £32,338, out of which they recommend the payment of the full statutory dividends, which (after providing for void houses) will leave a balance of £12,258 to be carried forward. During the half year to Sept. 30, 120 yards of additional street service mains were laid—the total length of these now being slightly over 175 miles. No trunk mains were laid during the six months; the length of them remaining as it was six months ago—namely, 67¾ miles. The net increase in the number of supplies was 148; the total number of premises under constant supply throughout the whole of the Company's district being (at the end of September) 54,086, and the number of consumers approximately 267,500. The quantity of water supplied for all purposes during the half year was 1,719,686,000 gallons—equal to an average supply of approximately 9,397,000 gallons per twenty-four hours. The Company's engines, boilers, filter-beds, reservoirs, mains, and works were reported by the Engineer and General Manager (Mr. Herbert Ashley, M.Inst. C.E.), to be in good working order. The back-dividends resolution referred to above will be moved in the following terms: "This meeting resolves that the following shareholders (not being Directors) be and are hereby constituted a Special Committee to consider and report to the shareholders at the next half-yearly meeting whether it is desirable that steps should be taken to provide for the payment of back-dividends, and if the Committee recommends that steps be so taken, then it is to suggest a suitable course for this purpose. And to this end the Committee is to confer with the Directors, and to have the assistance of the Secretary of the Company; and the expense of this inquiry is to be borne by the Company."

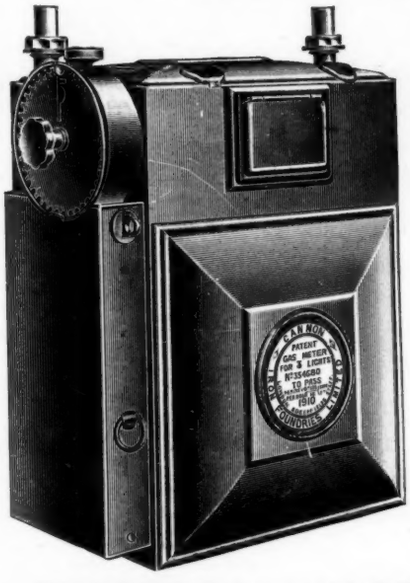
Midland Mayoralties and Gas Committee Chairmanships.—In two of the youngest among Midland municipalities the Chief Magistrates elected for the present year also hold the office of Chairmen of the Corporation Gas Committees. At Ilkeston, the re-election of Mr. J. A. Macdonald was for the third year in succession. Mr. Macdonald's excellent work for the municipality, and particularly in relation to the gas undertaking, has been widely recognized throughout the town. At Mansfield, the unanimous choice of the Council fell upon Mr. T. Smith, who has also acted as Chairman of the Gas Committee. Reference was made to trying difficulties with which, in this position, he had had lately to contend. The interesting circumstance was recalled that a few years since, during a period of change in the gas management, Mr. Smith acted as Manager of the Mansfield undertaking; and during his half year of office he had the satisfaction of contributing from the profits about £1500 in relief of the rates.

Oriental Gas Company, Limited.

The meeting of this Company will be held to-morrow week at the London Offices, Finsbury House, Blomfield Street, when the Chairman (Mr. H. D. Ellis) will have the satisfaction of presenting a report for the financial year to June 30 last showing that the final dividend of 4½ per cent. (making 8 per cent. for the year) has been earned with a slight balance in hand. In the course of the report it is stated that the effects of the war have been severely felt in India. Trade has been much hindered; enterprise repressed; and the normal demand for commodities abated. Economies have been enforced by stress of circumstances far and wide—upon corporate bodies, communities, and individuals. Among these economies, a saving of expenditure upon gas, wherever possible, and a contracted market for residual products, were to be expected. In contemplation of such a contingency the Directors took into their careful consideration how best to meet a prospective reduction of revenue by a diminution of expenditure consistent with sound economical principles, and the maintenance of the Company's works, plant, and buildings in a thorough state of efficiency. In this aim they have been successful. While, on the one hand, the revenue account shows a gas-rental lower by about 7¾ per cent., and a reduction of 18 per cent. in the yield of residual products owing to very severe market depression, large savings have, on the other hand, been effected under the chief heads of expenditure; and the item of bad debts and allowances is, in spite of war conditions affecting all classes of consumers, lower by £614 than the corresponding figures for the preceding year. In result, the reduction in revenue has been more than counterbalanced by £75 5s. 5d. The operations in the nature of extensions and additions properly assignable to capital expenditure have not been upon a considerable scale. So much had been done in the previous year to anticipate requirements of this nature that the comparatively light sum of £3200 covers all the outlay which has fallen to the charge of the year under review. The whole of this outlay has been defrayed out of the revenue of the year, without recourse being had to the reserve fund. The rate of exchange has been adverse, it is pointed out—a minor result of war conditions.

Middlesbrough Municipal Undertakings.—On assuming the office of Mayor of Middlesbrough, Mr. J. Calvert (late Chairman of the Gas Committee) said the total indebtedness of the town was £2,379,168, and the assets he calculated at £3,407,807. They had productive assets almost equal in value to the amount of the debt. Their share in the water-works (Tees Valley) was over £1,500,000; and the gas-works and electricity works had cost £600,000. Apart from the water-works, these enterprises did not cost the ratepayers anything. Two of them yielded something year by year; and even in regard to the water, it only cost the ratepayers a 0·82d. rate. If the value of these three productive works were deducted, it would be seen that they had redeemed as much money during the life of the Corporation as to pay for almost all their other properties.

THE "CANNON" Prepayment GAS METERS.



With Patented Radius Price Changer.

Ask for Particulars of

SPECIAL TEST

equal to

20 YEARS' WEAR.

NEARLY 80 YEARS' EXPERIENCE

is concentrated in our Meters.

CANNON IRON FOUNDRIES, LIMITED,

DEEPFIELDS, near BILSTON, Staffs.

London Office and Show-Rooms: BATH HOUSE, 57-60, HOLBORN VIADUCT, E.C.

Australasian Agents: MOLDEN & BUDDEN PTY., Ltd., 364A, Little Collins Street, MELBOURNE, Vic., and at SYDNEY, N.S.W.

Serious Gas Leakage from a Broken Main.—Suspicion rests on a Corporation steam-roller (which had recently been at work in the street), in connection with a serious occurrence at Bridgwater recently. On a man named Reed not turning up at his work last Friday week, a fellow employee called at his house to ascertain the reason; and entering by means of a window, he found Reed, his wife, and five children all unconscious in their beds, suffering from gas poisoning. The visit was a fortunate one; for no doubt had the victims remained undisturbed they would all have been suffocated. It appears that on the previous evening an escape of gas had been detected in the street; and the matter was reported to the Gas Company, who sent a man to investigate the matter.

Midland Gas-Workers' Organization.—In a report just issued by the Nottingham executive of the Gas-Workers' Union attention is directed to some significant figures; it being stated that, in the district of which Nottingham forms the centre, some 1200 men have, under the conciliation rules, received advances of pay. A war bonus of 2s. weekly has been obtained in a large perecntage of the cases. Further petitions are now being pressed, including one in connection with the Derby Gas Company. A statement in relation to the wider scope of the organization's operations throughout the country shows a total membership for September of 140,896, *plus* 28 per cent. now serving with the Colours, against 137,546 in June last. It must be remembered that the Union takes within the scope of operations, not merely gas-workers, but a host of others falling within the category of general labourers.

Nottingham Gas Committee.—The Nottingham Gas Committee has for the next year been enlarged by the addition of two members, and the scope of the work extended by the absorption of the duties hitherto discharged by the Lighting Committee, who have for many years fulfilled independent functions. Apart from the present abnormal conditions, which have brought the operations of the Lighting Committee almost to a standstill, the change has for some time been regarded as desirable, as tending to greater efficiency of working. With the return of normal times, one effect of the alteration may be to facilitate the adoption (the desirableness of which the Chairman of the Gas Committee suggested many months ago) of a standard burner for street illuminating purposes; it being felt that the Lighting Committee have been experimenting with an unduly large variety of types. To the great advantage of the city, Alderman Albert Ball will continue his services as Chairman of the enlarged body.

Doncaster Gas-Works Expenditure.—At an adjourned meeting of the Doncaster Town Council, Mr. Wightman took exception to a minute of the Gas Committee which recommended that, in view of the existing Treasury restrictions, further expenditure on new plant, mains, and meters be paid out of revenue. He wanted to know whether they had exceeded their estimate. Alderman Armitage replied that he was not aware that they had exceeded their estimate; and what work they did they proposed to do out of revenue. Mr. Clark said it was well known that the Treasury had refused to sanction any expenditure unless absolutely essential. They had agreed to an item of £270, and the new mains to which Mr. Wightman evidently referred were work which the Council would have agreed to, and a great public injury would have arisen if it had not been done. The work had been carried out in the most economical way. Mr. Wightman said he did not object to the work being done, but to the way in which it had been done.

The Fatality at Nelson.—The fatality to a labourer at the Brierfield Gas-Works of the Nelson Corporation, which was referred to on p. 336 of last week's "JOURNAL," was the subject of an inquest last Tuesday, when the Jury returned a verdict of "Accidental death." Deceased had been engaged in his ordinary employment of shovelling coke into the elevator to the hopper; and on search being made when he was missed, his body was found buried beneath the coke breeze in the hopper. Robert Frankland, foreman at the works, said deceased's duty was to receive coke from the trucks, and shovel it into the elevator, which carried it into the hopper. The full load of the hopper was about 5 tons, and 27 cwt. had been taken out during the last fortnight; but, in spite of this, it appeared to be full. He could not suggest how deceased had got into the hopper, because it was not his duty to go there; and it was situated 100 yards away from where he was working. The depth of the breeze was about 12 feet. He had never seen deceased go on to the top. After taking out 27 cwt. of the breeze, there would be a fairly large cavity. It was dangerous to step into the hopper and on the breeze; but he had never pointed this out to the men in any way. The hopper was not now in use. All the time the elevator was working, breeze gradually got into the hopper. If the mixture of the coke and breeze had been solid at the bottom, there would have been no danger. The Coroner said deceased, for some reason or other, went on to the top of the hopper containing the breeze and coke; and this collapsed beneath him, and in consequence he died from suffocation. He thought that in future directions would be given to the men that they must be very careful, and not get into these hoppers. The Town Clerk, on behalf of the Corporation, expressed sympathy with the relatives. The man had, he said, been perfectly satisfactory in his services.

APPLICATIONS FOR LETTERS PATENT.

15,344.—MILLER, A. J., "Gas-furnaces." Nov. 1.
15,351.—HODGSON, J. L., "Meters." Nov. 1.
15,467.—LYMN, A. H., RILEY, L. A., and RAMBUSH, N. E., "Gas-producers" Nov. 2.
15,480.—LIVESEY, R. M., "Acetylene generators." Nov. 3.
15,585.—JOHNSON, J. Y., "Gas-producers." A communication from W. Wood. Nov. 4.
15,628.—RADMORE, L., and MILLER, W. P., "Acetylene generators." Nov. 5.
15,701.—HERSEY, M. H., and ANDERSON, D., "Mantle rings." Nov. 6.
15,717.—MORGAN, P. B., "Gas-producer." Nov. 6. [Divided Application on 6999/15. May 10.]

The "WELBECK" with Hood.

PARKINSON'S "WELBECK" FIRE

will appeal to consumers who appreciate beauty of design.

Parkinson's Silent Burner

ensures a perfect flame. Dust, &c., can be easily removed without taking burner to pieces.

Highest Possible Heating Power

is obtained with specially designed Brick and Fuel.

The upright fuel is held in position by the curved top fuel.

Made in 14-in. and 17-in. sizes.

THE PARKINSON STOVE CO., LTD.,
BIRMINGHAM.
London Showrooms: 129, High Holborn, W.C.

STOCK MARKET REPORT.

THE general tone of the markets on the Stock Exchange last week continued to be favourable, coupled with strong points in some lines, and business was fairly active. But movements were not, and could not be expected to be, continuously upward, for the recent long run of rising prices led to the ever-inevitable realizations to secure profits. However, these ran their course unharmfully, and left markets unimpaired in vitality. The solid factors that make for enduring strength, the grand harvests, and the signs of advancing prosperity in many lands, still held good. Space does not permit detailed particularization; and it may suffice to say that this feature extended over both Hemispheres, with Canada in the West and Japan in the East as conspicuous examples. The progress of Home Rails in public favour was a welcome item. In the Miscellaneous group, advancing freights advantaged shipping. The most buoyant line was rubber, actuated by a smart rise in the market price of that commodity. A noteworthy event of the week was a large meeting of Stock Exchange members to urge the Committee to bar the re-election of all who are of alien origin—a numerous and powerful body. Much strong feeling was evinced, and a resolution was carried. It is a matter which is not devoid of difficulties; and the legal powers of the authorities should be carefully investigated. Another incident affecting the Exchange was the decision of the London clearing bankers to close at 3 o'clock. Business in the Gas Market showed some recovery in point of volume, and prices generally may be quoted as steady. Before the close, Imperial Continental was done at 70—this was after the general meeting of the Company held on Thursday. In the Money Market, short loans were easy, with an abundant supply; but the discount market was much perplexed on Friday by the advance to 5 per cent. for Treasury Bills of all dates.

Bargains done for cash during the week were as follows: On Monday, British 35⅛ Gas Light ordinary 76½, 77, ditto maximum 59¾, 60, Imperial Continental 65½, 66, South Metropolitan 75, 75⅛, 75½. On Tuesday, British 35½, Gas Light ordinary 76¼, 76⅜, 76½, 76⅝, 76¾, ditto debenture 62½, South Metropolitan 76, ditto debenture 60⅜, 60¾, 61. On Wednesday, Commercial 4 per cent. 80, Continental Union 38½, Gas Light ordinary 76¼, 76⅜, 76½, Imperial Continental 65, 66, South Metropolitan 76½, 77. On Thursday, Gas Light ordinary 76¼, 76⅜, ditto debenture 63, Portsea "D" 90¾, 90⅞, South Metropolitan 76½, South Suburban preference 90½, Tottenham "B" 98½, 99. On Friday, Continental Union 38½, Gas Light ordinary 76¼, 76⅜, ditto debenture 62¾, South Metropolitan 76⅛, 76⅜, 77. On Saturday, Gas Light ordinary 76½, ditto preference 73, 73½, ditto debenture 63, Imperial Continental 70, Primitiva 2 1/16, 2⅛, South Metropolitan 76¾. Recent dealings in Derby ordinary at 110-112½, and ditto debenture at 83-85, are reported.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

The Directors of the Monte Video Gas Company, Limited, have declared an interim dividend, payable on Dec. 1, of 6s. per share, less income-tax, for the half year ended June 30.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5½	Alliance & Dublin Ord.	59—64	8 18 2	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	4/6	Bombay, Ltd.	5½—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water: 10 p.c.	29—30	5 6 8	..
878,480	10	,,	7	7/-	Bournemouth Gas and Water: B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	4 5 9	..
147,240	—	—	—	4	Bournemouth Gas and Water: Deb.	..	—	..
880,000	Stk.	Feb. 26	†14	†6/-	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	†11	55/-	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	10½	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	7⅜	Do. A Ord. Stk.	154—159	5 0 3	..
580,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	35⅛—35½
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	..	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	80
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	38½
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6	Derby Con. Stk.	128—135	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	1/17/4	42/-	Gas Light and Coke: 4 p.c. Ord.	98—102	4 15 6	76½—77
2,600,000	,,	,,	3½	3½	Gas Light and Coke: 3½ p.c. max.	76—79	4 8 7	59½—60
4,062,235	,,	,,	4	4	Gas Light and Coke: 4 p.c. Con. Pref.	96—99	4 0 10	73—73½
4,674,850	,,	June 11	3	3	Gas Light and Coke: 3 p.c. Con. Deb.	72½—74½	4 0 6	62½—63
130,000	,,	,,	10	10	Gas Light and Coke: 10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜	6½	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	65—70
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
561,000	Stk.	Feb. 26	10	10	Liverpool 5 p.c. Ord. A	211—213	4 13 11	..
718,100	,,	,,	7		Liverpool 5 p.c. Ord. B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	4/-	Malta & Mediterranean Met. of Melbourne 4½ p.c. Deb.	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½		99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅜	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	6 9 0	..
60,000	50	Feb. 26	18	65/-	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5⅛—6	6 13 4	90½—90½
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4⅞—5	5 0 0	2 1/16—2⅛
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo: 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	San Paulo: 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	10	Do. B	223—224	4 9 3	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—77
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60⅜—61
209,820	Stk.	Feb. 26	8½	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—112	4 9 3	90½
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
137,058	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord.	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District: A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6	6	Tottenham District: B 3½ p.c.	115—117	5 2 7	98½—99
181,255	,,	June 26	4	4	Tottenham District: 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	5 7 4	..
80,000	Stk.	Feb. 26	8⅜	78/9	,, B 3½ p.c.	129—134	5 2 7	..
255,686	,,	,,	6⅜	63/9	,, C 3½ p.c.	110—115	5 2 0	..
108,075	,,	,,	5/17/8	55/1½	Wimbledon 5 p.c.	117—122	5 0 5	..
352,000	,,	,,	6⅜	57/6	Epsom 5 p.c.	121—126	5 5 2	..
98,000	,,	,,	6⅜	63/9	3 p.c. Deb. Stk.	66—69	4 6 11	..
88,416	,,	June 26	3	3				

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

The Engineer of the Walsall Gas-Works (Mr. B. W. Smith) has been instructed to report as to the adoption of a scheme of apprenticeship for the gas-fitters' lads, so that steps may be taken to have them properly trained.

The Doncaster Town Council have received intimation from the Treasury that there would be no objection to the borrowing of £286 in respect of capital already expended on mains, but that sanction could not be granted to any further borrowing for purposes of the gas undertaking.

To economize coal and gas, the Birmingham Education Committee have decided to revise the afternoon hours of the elementary schools. They will be half an hour earlier—from 1.30 to 4 o'clock.

The Leeds Corporation have issued a statement of their war allowances to Corporation employees who have enlisted; and it is shown that up to Oct 31 last 203 employees of the Gas Department who have enlisted have received £3550 in half-wages and allowances. The waterworks have sent 36 men. Of the total of 1649 contributed by all departments, 412 are officials and the remainder workmen.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

MANAGER. No. 6117.
SHOW-ROOM MAN. No. 6120.
GAS FITTERS. Sheerness Gas Company.
STOKER. Milford Haven Gas-Works.

Appointments Wanted.

GAS AND WATER ENGINEER, &c. No. 6118.

Plant, &c., for Sale.

PRODUCER GAS PLANT. Royal Gunpowder and Small Arms Factories, Enfield Lock.

Tank Waggons Wanted.

No. 6119.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.
Single copies by post, 8d.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 171, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

FOR

DRY METERS

TRY

JAMES MILNE AND SON, LIMITED.

SEND your inquiries for Carburetted HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—

BALE AND HARDY,
89, VICTORIA STREET, WESTMINSTER, S.W.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS.
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "DACOLIGHT LONDON." Telephone: 2336 HOLBORN.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT LIMITED.
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

TAR WANTED.

JOSEPH A. HUTCHISON, LIMITED,
HIGHBRIDGE WHARF, SOMERSET.

SULPHURIC ACID.

SPECIALLY prepared for the manu-facture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
6, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, FEN. LONDON."
Telephone: 1588 AVENUE (3 lines).

TAR AND GAS LIQUOR WANTED
IN LONDON DISTRICT.

THOMAS CLAYTON (Oldbury) Ltd.,
BRENTFORD, W.
Telegrams: Canal Brentford. 'Phone: Ealing 17.

J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, London, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB LONDON."

FOR

PREPAYMENT METERS

TRY

JAMES MILNE AND SON, LIMITED.

TAR WANTED.
THOMAS HORROCKS & SONS, LTD.,
Albert Chemical Works,
NORTON STREET, MILES PLATTING, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Lysol, Sulphate of Ammonia.

ALDER AND MACKAY
(ESTABLISHED 1850).
WET AND DRY METERS.
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.

ENQUIRIES SOLICITED.
FOR Gas-Works Plant of Every De-scription; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS,
C. & W. WALKER, LIMITED,
DONNINGTON, NEWPORT, SALOP.

RICHARDSON'S
"PLUTONIC" FIRE CEMENT.
(Powder or Paste).
For Gas Retort and Furnace Repairs, &c.
(42nd Year of Sale).
Prices and Samples free on Application.
THE "PLUTONIC" CEMENT COMPANY,
Telegrams: 62, BISSELL STREET,
"PLUTONIC, BIRMINGHAM." BIRMINGHAM.

HUTCHINSON BROTHERS, Ltd.,
FALCON WORKS, BARNSLEY.
MANUFACTURERS OF
GAS METERS (Ordinary and Prepayment),
"FALCON" INVERTED LAMPS and SQUARE LANTERNS for Street Lighting,
INVERTED BURNERS and CONVERSION SETS for Street Lamps.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
FIRTH BLAKELEY, SONS, AND COMPANY, LIMITED, Church Fenton, near LEEDS.

TAR WANTED.
THE Burnden Tar Company (Bolton), Ld.
HULTON CHEMICAL WORKS, BOLTON.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the Enrichment of Gas.
Manufactured and Supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agents, F. J. NICOL & Co., Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

OXIDE OF IRON.
We are in a position to Supply Oxide of Iron promptly, and invite Enquiries.
SPENT OXIDE WANTED.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
5, CROOKED LANE, LONDON, E.C.

FOR

ALL METERS

TRY

JAMES MILNE AND SON, LIMITED.

SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, p. 354.

MEWBURN, ELLIS, AND PRYOR.
CHARTERED PATENT AGENTS AND
TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 3, St. Nicholas Buildings, Newcastle-on-Tyne.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: "SATURATORS BOLTON." Telephone 0848.

JOHN RILEY & SONS, Limited, Chemi-cal Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

ADVERTISER, at liberty end of the Year, desires APPOINTMENT, either at Home or Abroad. Many Years' Practical Experience as Gas and Water Engineer and Manager; also as Assistant-Manager and Chemist on large Chemical and Coke-Oven Works. Thorough Practical Knowledge of the Manufacture of Bye-Products from Coal. Excellent References.
Address, No. 6118, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

MANAGER Wanted for a Gas-Works in the West of England. Annual make, 25 Millions. Salary, £150 per Annum.
Apply, by letter, stating Age, Experience, &c., and when free to commence Duties (no original Testimonials need be sent in the first instance), to No. 6117, care of MR. KING, 11, Bolt Court, FLEET STREET, E.C.

WANTED — Good Gas-Fitters, Ex-perienced in Iron and Compo. Work and General Gas Appliances. Permanency to reliable men. Wages, 7d. per Hour and War Bonus.
Apply, with *copies* of Testimonials, to the MANAGER, Gas Company, SHEERNESS.